SEP 22 1921

VOL. LXXXIX. No. 2285. [All Rights Reserved.] SEPTEMBER 9, 1921. [Registered at G.P.O. as a Newspaper and Canadian Magazine rate of postage.] PRICE SIXPENCE

LONDON: PUBLISHING OFFICE, 4, LUDGATE HILL, E.C. 4. SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 6d.; Canada, £1 12s. 6d.; Colonial and Foreign, £2 1s. 6d. per annum.—NEW YORK: D. VAN NOSTRAND CO., 25, Park Place, New York City. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, Librairie, Etrangère, 22, Rue de la Banque.
Telegraphic Address: "Ageekay, Cent., London." A B C Code. Telephone Nos.: Central 8260 and 8261.

LITHOLITE INSULATORS, Ltd.
66—67, Hackney Grove, London, E. 8.
'Phone and Telegrams: Dalston, 292, London.
FIREPROOF AND OTHER GRADES
ESTABLISHED 20 YEARS.

Birkby's "ELO"
For all purposes for which moulded insulation is required specify "ELO"—which is water, oil and heatproof.
FLEMING, BIRKBY & GOODALL, LTD., LIVERSEDGE, YORKSHIRE.

WRIGHT 'Phone: 499. Tel.: Motor.
A.C. and D.C. **MOTORS.**
WRIGHT MOTORS, Ltd., HALIFAX.

EVERY DESCRIPTION OF
SMALL TURNED PARTS and CASTINGS
for ELECTRICAL ENGINEERS.
A. MORTON,
6, Tenby Street North, Birmingham.

BROOK
ONE, TWO and THREE-PHASE
MOTORS.
See Sup 37.

SWITCHGEAR.
ERNEST F. MOY, LTD.,
Manufacturing Electrical Engineers and Government Contractors.
GREENLAND PLACE, CAMDEN TOWN, LONDON.

MICA & MICANITE
TAYLOR & PETTERS, LTD.,
40, Hatton Garden, London, E.C. 1.
'Phone: 4575 Central.
See page ii.

MOTORS. • DYNAMOS.
VICTORIA DYNAMO & MOTOR CO.,
CRAVEN HOUSE,
Kingsway, London, W.C. 2.
'Phone: Gerrard 1245.

CHURTON
SINGLE and POLYPHASE
MOTORS.
T. HARDING CHURTON & CO., LTD.,
Atlas Works, Water Lane, LEEDS.

ELECTRIC MOTOR REPAIRS.
ARMATURES REWOUND.
H. DUNN & SON,
Newington Causeway,
Tel.: Hop. 1167. LONDON. S.E. 1

"EMPIRE"
AUTOMATIC CONTROL
FOR
Pumps, Compressors, Machine Tools.
ELECTRIC CONTROL, LIMITED, GLASGOW.

WESTERN-ELECTRIC
COMPANY, LIMITED
Norfolk House, Victoria Embankment, W.C.
Works: NORTH WOOLWICH, LONDON, E.
TELEPHONES & CABLES.
See Advertisement last week, p. xxxix.

CONNOLLY'S (BLACKLEY), Ltd.
for
WIRES AND CABLES.
See Advertisement this week, p. iii.

WHITE
Electrical Instrument Co., Ltd.
2, 4 & 6, GLOUCESTER ST.,
CLERKENWELL, LONDON, E.C. 1.
Wire: Voltograph, London. 'Phone: Clrv. 8660

ELECTRIC MOTORS.
One, Two and Three-Phase.
BRITTAIN'S ELECTRIC MOTOR Co.
(Late Langdon-Davies Electric Motor Co.),
110, Cannon Street, London, E.C. 4.

INSULATING
- - BEADS - -
Immediate Delivery.
HOLDER-HARRIDEN LTD., 35/37, Noble St., London, E.C.

An Old English Garden.
See Sup. 12.

For Suction and Delivery, Acids and Alkalis.
HOSE.
DERMATINE
DERMATINE CO., Ltd.,
Neate St., London, S.E.5

SHUNT REGULATORS.
MOTOR STARTERS and all classes of Resistance Work.
STAR DELTA SWITCHES.
THE SOLENOID REGULATOR CO.,
HIGHGATE SQUARE, CAMP HILL,
Telephone: Midland 842 BIRMINGHAM, Telegrams: Solenoid, Birmingham.

MAVOR & COULSON, Ltd.,
GLASGOW.
MOTORS, DYNAMOS, SWITCHGEAR.

CHEAP POWER means ALUMINIUM.
See Sup. 5.
British Aluminium Co., Ltd., 100, Queen Victoria St., London

RAYNER & HEALD, LTD.,
DUKE STREET, DERBY.
TWO & THREE-PHASE MOTORS only.

FULLER'S UNITED ELECTRIC WORKS, LIMITED.
MANUFACTURERS OF
ACCUMULATORS BATTERIES
WIRES & CABLES CARBONS, &c.
WORKS: CHADWELL HEATH, ESSEX.
General Sales Offices:
IDDESLEIGH HOUSE, Caxton St., Westminster.
'Grams: Blochat, Vic. London. 'Phone: Victoria 6863.

INGLEBY & CO.,
Old Lane, Beeston, LTD.
MOTORS LEEDS.
FOR DIRECT AND ALTERNATING CURRENT
Tel. 20275
Delivery from Stock up to 50 H.P.

Advertisement Index, see page xliv.

SWITCH ON EDISWAN

For any of the following Electrical Supplies:—

Accessories.
Accumulators.
Bells & Accessories.
Circuit Breakers.
Controllers.
Decorative Fixtures.
Decorative Glass Ware.
Dry Cells.
Dynamos.
Electric Fires and Radiators.
Fans and Ventilators.
Heating and Cooking Appliances.
Industrial Fittings.
Inert Cells.
Instruments—Indicators.
Instruments—Meters.
Ironclad Switch Gear.
Lamps Royal Ediswan gas-filled & vacuum types.
Leclanche Cells.
"Little Glutton" Vacuum Cleaner.
Motors.
Oil Switches,
Telephones & Accessories.
Wires and Cables.

Mark the items in which you are interested and post this page to us, when we will gladly supply full information.

THE EDISON SWAN ELECTRIC CO., LTD.,
PONDERS END, MIDDLESEX.
London Showrooms:
123-5, Queen Victoria St., E.C. 4 & 71, Victoria St., S.W.1

"STACC" GRIP FITTINGS.

(Patent 4426, 1912.)

NO CROSS CUT ON THEM TO DESTROY CONDUCTIVITY.

NO CLEANING ENDS.

CORPORATIONS BEWARE OF IMITATIONS

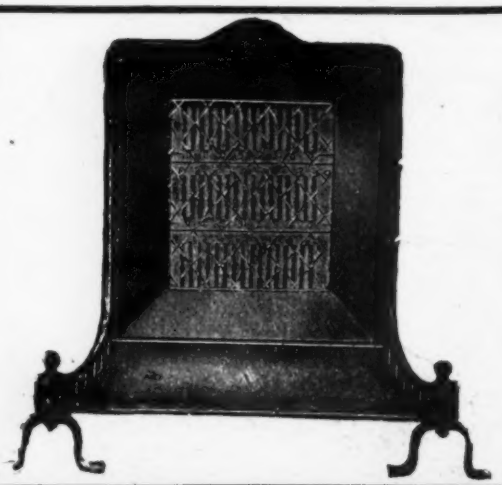
All Classes of Conduits and Fittings.

STEEL TUBES & CONDUIT CO.,
ALICE STREET, KEIGHLEY.
Telephone: 260. Telegrams: "Progress."

MICA & MICANITE

INSULATORS FOR EVERY DESCRIPTION OF ELECTRICAL WORK.
Contractors for Air Board, War Office and Admiralty Requirements.
CUTTING AND GAUGING OUR SPECIALITY.
BEST QUALITY MICA ONLY.

'PHONE—4575 CENTRAL.
TELEGRAMS—"MICAYLOR, LONDON"
TAYLOR & PETTERS, LTD.,
40, HATTON GARDEN,
LONDON, E.C.1.
(The Oldest Established Mica House in the country.)
AND ALL BRITISH.



THE
ARORA ELECTRIC FIRE

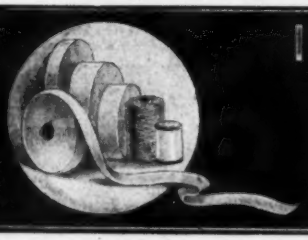
Has given universal satisfaction.

WHY? Because OUR patented Element is of HEAVY SECTION and has LOW Current Density, yet it glows at a HIGH TEMPERATURE.

Low Price, Robust, Cheery, Economical.

Write for List E (Fires & Cookers) to Sole Manufacturers:

THE ARORA CO., Loughborough.
(Proprietors: Messenger & Co., Ltd.)



INSULATING MATERIALS - *Delivery from Stock*
SUPERFINE COTTON, LINEN & SILK TAPES,
DYNAMO TAPES, FIELD COIL WEBBING, CABLE TAPES,
ADHESIVE TAPE, TUBULAR SLEEVING, ARMATURE BINDING CORDS &c.
JOHN MACLENNAN & Co
115 NEWGATE STREET LONDON E.C.1.
Telephone - City 3115
And at GLASGOW

THE

ELECTRICAL REVIEW.

VOL. LXXXIX. SEPTEMBER 9, 1921. No. 2,285.

ELECTRICAL REVIEW.

Vol. LXXXIX.] CONTENTS: September 9th, 1921. [No. 2,285.

	Page
Supply Without Statutory Powers	329
The Engineering Exhibition	330
The Institution of Electrical Engineers	330
The Engineers' Club	330
The Testing of Electricity Meters, by R. M. Moberly	331
The Spirit of Goodwill in Electricity Supply, by J. W. Thomas	334
The Bradford Housing Scheme	336
New Electrical Devices, Fittings and Plant (*illus.*)	336
Electrical Vehicle Results	339
Dust Removal Equipment	340
Correspondence—	
A Motor Problem	340
A Question of Sincerity	341
Flickering Light	341
Supply Without Statutory Powers	341
Trade Terms and Direct Trading	341
The E.P.E.A. Schedule and Economy Stunts	341
A Warning to Contractors	341
A Novel Sign	342
Carpets and the Electric Suction Cleaner	342
High-pressure Transmission Line Insulators	342
Legal	342
Business Notes	343
Notes	349
City Notes	351
Stocks and Shares	351
Market Quotations	352
The British Association	353
Problems of Physics	354
The Reception of Wireless Waves on a Shielded Frame Aerial	356
Cost-of-Living Sliding Scales	357
The Breakdown of the Minimum Wage	357
German Commercial Penetration in Switzerland	357
Electrical Enterprise in Czecho-Slovakia	358
Reviews	358
New Patents	360
Published Specifications	360
Contractors' Column ... Advertisement page	xxx

"ELECTRICAL REVIEW" SUBSCRIPTION RATES.

UNITED KINGDOM	£1 14 8	per annum.
CANADA	1 12 6	do.
COLONIAL and FOREIGN	2 1 6	do.

Postage Free.

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 6d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE, 4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGREKAY, CENT., LONDON." Code, A B C.
Telephone Nos.: Central 9260 and 9261.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.
AUCKLAND, N.Z.: Gordon & Gotch, Albert Street; Peter G. Tait, P.O. Box 392.
BRISBANE: Gordon & Gotch, Queen St.
CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.
DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.
JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH &c. Central News Agency, Ltd.
LAUNCESTON: Gordon & Gotch, Cimitiere Street.
MELBOURNE: Peter G. Tait, 90, William Street; Gordon & Gotch, Queen Street.
MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 25, Park Place.
PARIS. Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Loescher & Co., Corso Umberto 1° 307.
SYDNEY: Peter G. Tait, 273, George Street; Gordon & Gotch, Pitt Street.
TOKYO: Maruzen Co., Ltd., 11-16, Nihonbashi-Teri-Sanchome.
TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.
WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "London City and Midland Bank, Newgate Street Branch."

SUPPLY WITHOUT STATUTORY POWERS.

In view of the fact that the electricity supply system of this country is supposedly undergoing, or about to undergo, a more or less drastic process of reorganisation, it is not surprising that many of the smaller undertakings, both authorised and otherwise, are concerned as to the future prospects of their respective businesses. From time to time we receive inquiries in this regard, one of which appears in our "Correspondence" columns to-day.

There is no doubt that, as our correspondent claims, in many cases small non-statutory companies have rendered public service by providing a supply of electricity in areas which would otherwise have been deprived of that privilege for years. In some respects their operations have been conducted under more advantageous conditions than those of duly authorised undertakers; as a rule they have not been able to lay mains underground—but that is not necessarily a disadvantage, and, on the other hand, they have enjoyed a measure of freedom denied to the statutory concerns. They have, in fact, embarked on a trading enterprise on much the same footing as a grocer or a dairyman.

Now that the Electricity (Supply) Act, 1919, is in force, and the No. 2 Bill is awaiting Parliamentary approval, these companies are taking stock of their position; but apparently they have little cause for apprehension.

Section 26 of the Act of 1919 enables unauthorised suppliers of electricity to become authorised undertakers by means of Special Orders made by the Electricity Commissioners; they will then enjoy the privileges of such undertakers under the Act—that is, they may sell the whole or any part of their undertakings to the Joint Electricity Authority by agreement, or they may elect to remain outside the Authority, in which case apparently there is no power to interfere with them, but they cannot extend their generating plant or main transmission lines without the consent of the Commissioners. It is impossible to prophesy the policy of the new Authorities, but the Commissioners have definitely stated that they will not forbid the extension of an undertaking if it can be shown that such extension is of greater benefit to the public than the alternative course of obtaining a supply from a distant source (ELEC. REV., March 4th, 1921, p. 269). There is no reason to suppose that an unauthorised supply, commenced before any Provisional Order has been issued for the district, can be shut down by any legal process. Under Section 23 of the Act of 1909, while the initiation of an unauthorised supply in any district for which statutory powers had already been granted was forbidden, the section implicitly permitted the continuance of such competitive supply where it had been commenced before the passing of that Act; it explicitly allowed any company to supply electricity to the public, where the business of supplying electricity was not the main purpose of the company, and it placed no obstacle in the way of the commencement of supply without statutory powers in an area not covered by a provisional order.

The Act of 1919 has not materially altered the position except as indicated above. But it is true, as our correspondent suggests, that an unauthorised undertaking has no *locus standi*; if a public supply becomes available in its area, it certainly need not "clear out," but must face the competition as best it can, without pro-

test, and without hope of extension of plant *unless it can beat its rival on selling price.*

Now, the words italicised contain the kernel of the argument. There is no doubt that in some cases the small local unauthorised undertakings, with plant purchased at pre-war prices, and working on economical lines, will be able to defy any competition from a newly established supply, whether from a distance or locally generated. No one can shut them down—as the law stands at present; and if, as mentioned above, they are able to obtain a special order endowing them with statutory powers, their position will be impregnable.

However, they must not calculate their costs in the manner indicated by our correspondent, who tacitly assumes that the oil-engine set is going to run at full load and maximum efficiency when it runs at all, and makes no mention of interest on capital or allowance for depreciation or obsolescence (say, 20 per cent. per annum together), or rent, rates, labour, lubrication, and repairs. That "horse-power-hour for 1d." is an old story—in a double sense. As we have said, in some cases the small private plant will undercut any public supply of future development; but in many cases it will be found, on an impartial investigation, when all the relevant charges have been fairly taken into account, that the apparent cheapness of the supply given by the small plant is only apparent. Hence we recommend the owners of such plant to make sure of their ground before they commit themselves to any definite policy.

The Engineering Exhibition.

On Wednesday the Shipping, Engineering, and Machinery Exhibition was opened at Olympia for its three weeks' run. Coming at a time when the trade barometer is distinctly rising—as evidenced by the reopening of iron and steel works, the reduction of unemployment, &c.—the Exhibition ought to provide a valuable stimulus and produce useful results. It should be borne in mind by exhibitors that to equip a stand and place a man in charge of it is not the sum of their duties to themselves and to their potential clients; assuming that the exhibit is well selected and displayed, and that the attendant is not merely a man, but a competent demonstrator, able and eager to explain the operation and merits of the items shown, it remains to ensure that he shall be well supplied with visitors interested in the class of goods concerned. There are various ways of attaining this end, which need not be detailed; our object is only to point out that they should not be neglected.

Again, the immense educational value of such an exhibition should be duly appraised, and the opportunity should be taken to turn it to the best possible account. In this respect we appeal not only to exhibitors, but also to manufacturers and traders in general, to make use of the exhibition and increase its efficiency by enabling the members of their staffs, from the heads of departments down to the apprentices, to visit the exhibition, and make a thorough study of its contents. Tickets can be obtained at specially reduced rates for this purpose, and arrangements have been made with the railway companies to run excursion trains. To be up to date is all-important, and the only way to do it is by keeping oneself fully conversant with the march of progress in the engineering world in general. We, therefore, trust that our readers will assist, so far as lies in their power, in promoting the technical education of their fellow-workers by this excellent means.

The Institution of Electrical Engineers.

The June issue of the I.E.E. *Journal*, which has just been issued, contains under "Institution Notes" a novel feature—a valedictory letter from the President to his fellow-members, recounting the principal achievements of the session which is now drawing to a close, and thanking the members of Council and all the members for the assistance they have given him during the year. Mr. Atkinson has a gift for doing, and saying, the unexpected thing, with which, fortunately, is associated an unerring sense of what is fitting; and hence no one can fail to appreciate the spirit in which his message is conceived. He pays a special tribute to the effective work of the honorary treasurer, Sir James Devonshire, as well as to that of the secretary, Mr. Rowell, and his staff, but he makes no reference to his own labours, which must have been as arduous as they were successful—and that is no faint praise, for, as he remarks, "in many ways it has proved a record session."

Already we are looking forward to the next, which officially commences when this month ends. The Council is still engaged in debating the very difficult question whether the meetings shall begin at 6 o'clock or at the former hour of 8 p.m.—difficult, because so many members hold strong views one way or the other. While we have our own opinion, it is a matter for individual decision, upon which we do not care to comment. But we think we shall voice the views of a good many members if we suggest that the informal dinners, inaugurated by Mr. Wordingham, and abandoned only because of adverse circumstances, might now be revived, and that no more suitable rendezvous could be found than the Engineers' Club.

The Engineers' Club.

Engineers of all branches of the profession will be glad to learn that the Engineers' Club (London) was duly opened last week, and that from the very first it "made good." On the opening day the luncheon rooms were fully occupied, and most of the sleeping accommodation was booked; and since then the attendance at and use of the club has been all that could be wished. So far as we have been able to ascertain, the members generally are very pleased with the arrangements provided for their comfort and convenience, and there is every reason to forecast a prosperous future for the new institution.

How to Enter the Jugoslav Market.

Jugo-Slavia, the kingdom of the Serbs, Croats, and Slovenes, has to import from abroad machinery, all kinds of railway material, scientific instruments, brass, copper, steel, &c., amongst other goods, which the United Kingdom should be in a position to supply. Unfortunately, the purchasing power of the new kingdom is limited, and though gradually recovering, must remain restricted until its resources are developed. To this end capital is needed, transport must be improved, and labour requires to be reorganised. By co-operating in these directions with local interests, British entrepreneurs would be making a useful contribution towards the reconstruction of a promising region, and might at the same time gain an outlet for British goods.

The prospects facing such schemes may be gauged from the report by H.M. Commercial Secretary at Belgrade, which has recently been issued by the Department of Overseas Trade. The main factors which affected trade in British goods last year were: (1) Exchange variations; (2) time taken in transit of goods; (3) terms of purchase—cash or credit; (4) Valuta competition.

The last named was very marked, especially from Austria, Czecho-Slovakia, and Italy. Machinery, copper, motor cars, tires, and iron and steel goods were amongst the articles affected by this competition.

In the Commercial Secretary's opinion, the best way for firms to enter the market is for them to have branches in the country and carry stocks; by this method, the local merchants, by purchasing goods of which they can take immediate delivery, can obviate the risk of loss from exchange fluctuations which must be taken when ordering goods from abroad, the period occupied by the transit of merchandise being so uncertain. Where this is not possible, the next best way is to have a British representative living in the country.

THE TESTING OF ELECTRICITY METERS.

By R. M. MOBERLY.

Just as a power canvasser does not labour the comparison of costs of electricity *versus* other methods of driving, but rather concentrates on the increased or improved output available when the electric drive is used (since power costs, although important, form only a small portion of the total cost of production, whilst increased sales are very important), so a supply engineer regards, or should regard, the importance of output, and should be willing to go to a reasonable expenditure to increase his sales. Money is spent in advertising, and in canvassing, but expense for the upkeep of meters is frequently frowned upon. The money spent to buy meters represents a by no means negligible portion of the total capital expenditure, and although this may be considered to be depreciated duly by the income received from meter rents, it would be better to regard this revenue as providing a maintenance and renewal fund, and by systematic care to keep the meters in good condition.

The securing of maximum sales implies minimum loss in distribution, which in turn implies meters in good condition, and fast up to the statutory limits. This last desideratum is a reasonable aim, and one which does not necessarily involve great preliminary outlay, elaboration, or running cost, but which, when decided on, must take cognisance of certain incidentals which make all the difference in obtaining quick and reliable results. These incidentals are: (1) Instruments; (2) variation of test load; (3) accuracy of observation; (4) accuracy of preliminary calculations, and calculations during test; (5) personal element, eye strain, fatigue, &c.; (6) miscellaneous items.

In starting a test room of moderate capacity, these incidentals may be considered in the following manner:—

Personal Element.—The way of the man who gets through his work well, but is apparently lazy, is often the best. The "lazy man" method should, therefore, be kept in view in the arrangement of the test room, so that a bench and chair of proper respective heights are provided for one class of meter, and suitable racks and a stool for other types. The position of control should be as nearly central as convenient.

Instruments.—The most exact, showing the clearest definition of the smallest variation over a large range is naturally the best, but no doubt a potentiometer and good reflecting galvanometer with an N.P.L. certificate, or a Kelvin balance, are too expensive to consider, so it is necessary to take the best that the powers that be will pay for, have it periodically checked, and assume it to be correct between checks unless proved otherwise. As the limits of accuracy prescribed are expressed as a *percentage*, values from beginning to end should be considered on this basis. Instrument scales should be as large as possible, and should be calibrated so that fine readings may be taken, a mirror below the needle being, of course, essential. Shunts or transformers should be so graded that for the majority of readings required for every-day meter testing, the pointer will be on the high side of at least 50 scale divisions, where one division (equal to a variation of 2 per cent.) is as clearly read, as at 10 scale divisions where one division is equal to a variation of 10 per cent.

Variation of Load.—For d.c., current from accumulators is essential. As the cost of sufficiently high-discharge-rate accumulators for a separate installation is prohibitive, it is best to use regulating cells of the main battery. Eight cells form a useful group, and these should be the last regulators in the battery, so that the effect of outside conditions is reduced as much as possible. A spirally wound heating element with suitable tappings forms the cheapest type of rheostat for the calibration of voltmeters, whilst voltage from the busbars, with the addition or subtraction of a few volts by means of test cells or independent small cells, answers the requirements of voltage circuits in energy meters.

For a.c. testing, as the phase difference comes into consideration, and as the type of standard instrument most suitable for obtaining quick results is different, it is often best to use energy from the busbars through suitable banks of lamps, heaters, &c. The instrument recommended for use as a substandard is a portable rotating standard as supplied by the British Thomson-Houston Co., or the Metropolitan-Vickers Electrical Co. Several ranges are obtainable with either instrument by means of variable series coil connections, and usually two or more voltage ranges can be supplied. With such an instrument quick readings can be obtained with the advantage that fluctuations in the supply will not upset the tests. A good ammeter and voltmeter may be obtained, but although useful for power factor tests, such tests are of little practical value with modern meters in which the range of power factor met with in commercial practice makes less than 1 per cent. difference. Suitable inductances and choking coils complete the requisite equipment.

Accurate Observation.—Absence of eye strain is essential. The eye must obviously be in the same alignment at the beginning and end of each test, but need not be in the interval, hence it is obvious that good aligning marks must be available. The meter under test usually contains one such mark such as the spindle, the end of a magnet, &c.; the other alignment can conveniently be external, made to stand or hang in front of the meter. It is then only necessary to align the eyes for perhaps 10 seconds in 60, and to remember whether it was the head or tail of the disk mark that was counted at the start. A lamp with a concentrating lens to throw a beam of light into the meter under test is also helpful.

Preliminary Calculations, and Calculations during Test.—The lazy man will endeavour to eliminate the latter entirely, if possible, by paying more attention to the former. A percentage chart on a large scale showing the error of any reading from the constant, or the variation between any two constants in the tables, saves much time, especially in the case of meters with readily changeable constants, such as Chamberlain & Hookham or Ferranti meters. A variation chart to and from 60 will be required for meters in which the constant is calculated in revolutions per *minute* at full load. A variation chart to and from 60, and to and from various other numbers will be required for meters in which the constant is calculated in revolutions per *unit*, and also a standard relationship between this constant, number of revolutions, time and load. (If one works in revs. per minute, fractions of revs. come in, involving the use of a slide rule during test.) In each case variation per cent. must be obtainable from the charts, for direct entry on the test sheet. As the majority of meters to be dealt with will not be above 100 amps. capacity, it is as well to provide circuits as follows:—

D.c. Battery Cables.—So that one or more cells up to the full number (eight) may be used in series the cables of 70-A capacity should terminate in a simple plug and socket, a bar and clamp, or what is more economical in space and expense, a mercury switchboard. From the switchboard at least three circuits should be run to different positions terminating in good screw terminals on walls or benches. Provision should be made on the switchboard so that any of the ammeter shunts can be readily connected into any of the circuits in series with any number of the test cells.

Flexibles for connecting meters may be conveniently made up of 7/18 or 7/20 cable sweated into suitable lugs, easily obtainable from Davis & Timmins, as a standard terminal, but with the screw thread omitted. The terminal to take 7/18 will be found to have the right size stalk for most meters except Chamberlain & Hook-

ham, which require an extra ¼ in. length in the stalk. The thimble part of this terminal can be used in larger sized meters. A number of barrel connectors for this size will also be useful.

Resistances.—A pair of good carbon resistances and a small carbon cloth pile will give all the variation required from 100 amperes to 1/100 load on the smallest meter used. The plate resistance should have either smooth or corrugated plates about 3½ in. square by ¼ in. thick. The carbon cloth pile should have three terminals, and be provided with a robust short-circuiting switch so that it may be arranged in the circuit in use and set at the beginning of a range of tests to give the required light load by opening the s.c. switch. Thus full load may be obtained with four cells, half with two cells, one-fifth with one cell, and one-tenth with one cell and the s.c. switch opened. If instruments are so arranged that the tester can tell when any variation in the current occurs during test, one or two small carbon resistances, consisting of full size plates, but only a few in each, may be conveniently connected in the test circuits, so that any such variation may be corrected without interruption of the test.

Comfort makes a considerable difference to the lazy man. A good chair, with the provision for a test pad, and a tray for the small number of tools required for minor adjustments, makes all the difference; the provision of wheels is an improvement, but might be considered too luxurious. A similarly arranged stool for working at meters on the racks, and a good stopwatch complete the main items.

When a batch of meters comes in from the makers, it is as well to look out for one or two different sizes which have remarkably good curves, and to install these permanently in the test room so that after other tests a batch of meters can be put in series with the selected meter of suitable size, and run on dial test. The dial testing may be conveniently done on the office or works lighting or heating circuits, thus not occupying the switchboard, or using current unnecessarily.

A standard set of resistances is arranged so that 1/100 load for any size of meter can be obtained quickly, as all meters should be first tried at this load, the "jibbers" being put on one side for examination, and the good ones passed on for test. Mercury meters which "jib" or pass 1/100 load test, if over five years of age, should be opened up for examination, since disk trouble or oxide, or more rarely jewel trouble may have started. The corrosion of gear wheels, especially when the meter contains any ebonite or similar substances, is sometimes sufficient to cause slow running on light loads. (The remedy for this is to dip the gears and relacquer.) Jewels, in motor meters especially, but also in mercury meters, sometimes split or flaw, and it is of interest to note the serial numbers of all meters in which jewel trouble occurs, since it sometimes happens that the manufacturers have had a poor batch of jewels, and the same trouble may be found over the next serially numbered meters. Although expensive it is not altogether a counsel of perfection to insist on a new pivot for every new jewel—the microscope will show that this is justified in most cases.

When meters have been brought in on account of being "alive" it frequently pays to examine the customer's premises, and in fact sometimes leads to the customer's paying for the repairs. As a.c. meters are of the energy type, and practically all have both heavy and light load adjustments, it is not worth specially detailing the different types. In overhauling the same main features require special attention. The testing is most conveniently carried out by means of the rotating standard, which is connected up with its series coils in series with the meter to be tested, and with the pressure coil across the supply mains, but nearer to the supply than the meter under test (this will obviate measuring the pressure coil loss in either meter).

The pressure coil of the standard has a hand switch in circuit so that the standard can be started readily, run for a period during which N revs. of the disk of the meter to be tested are counted, and the standard stopped on completion of the counting. The test is made by comparison of the registration on the standard, showing the number of revolutions run during the test, and the number counted on the meter under test. By a little preliminary calculation it will be found possible to measure percentage error directly.

The following brief notes and tables may be of assistance to someone starting a test room:—

Chamberlain and Hookham Meters.—Mercury type motor meter, constant = amp. × secs./revs. Calibration is effected by means of varying the position of the poles of the correcting coil. If the curve is straight, but outside the limits, the constant can be readily changed.

Stock desirable: Set of change wheels, single, double, and triple worms, balance weights, bottom pivots, bottom jewels, spare armature disks and spindles, a few hands for clock dial, a d.c. spanner of brass or non-magnetic material size 9/16 in. across flats and ⅛ in. square, and a spanner for jewel adjustment 11/32 in. across flats and 7/16 ditto.

For the 1907 type meter the following additional tools are essential: A special grooved box spanner for the spindle and a clip for holding the armature when unscrewing the spindle.

On the 1897 type, adjustments are made by either raising or lowering the brake poles or by altering the effect of the correcting coil by non-magnetic packing between the coil core and its mounting. If full load is slow, half load fast, and one-tenth load slow, speed up the meter or remove the packing. If the curve falls from fast at top load to slow at bottom load too steeply, insert packing. The main point is to try for the best curve, without packing, by altering the speed and then correcting the resultant curve if necessary, finally changing the constant if essential. When overhauling this type of meter the points to be specially noted are the condition of the top bearing, of varnish on the armature disk, of the jewel and bottom pivot, of the leather between the ebonite base plate and the pole pieces (as occasionally the copper connecting strip from the bath to the terminals becomes amalgamated and the mercury penetrates through the leather forming a short circuit), and the position of the bottom pole piece which supports the pivot, since curve variation can be obtained by revolving this pole piece.

For the 1902 type, adjustment is made by varying the strength of the correcting coil by means of tappings provided. In overhauling special attention is required to the condition of the varnish, and light load friction losses.

For the 1907 type, a special box box spanner is required for the spindle and clip to hold the armature when the bath has been opened by the removal of the strap. Adjustment is made on the screws forming the poles of the correcting coil; as this affects top loads most, friction losses require special attention. The insulation under the clamps holding the meter into the case is liable to split, especially where the fit is not good. Rust may form on the pole pieces in the bath. (See under "Ferranti" also.)

Messrs. Chamberlain & Hookham now claim to have obtained a varnish which will withstand the action of mercury on copper. This will obviate the necessity of burning off the mercury and reinsulating the disks.

Ferranti.—Mercury type motor meter. Constant = amps. × secs./revs. Calibration by means of adjusting a pole piece, which distorts the flux in conjunction with the series coil, chiefly affects top loads, so attention to friction losses on light loads is important. The constant can be varied by change wheels and pinions.

The stock desirable consists of a set of change wheels, four sizes of pinions, jewels complete with holders, fibre disks for mercury bath (few only), selection of armature disks and spindles. Special tools, No. 2 box spanners for mounting jewels, and special keepers for use on magnets when stripping.

With care a meter may be stripped, overhauled, and re-erected without any or with very slight alteration of the constant being necessary.

Special attention during overhauling is recommended to: Enamel on disk; even if the meter is five years old and the enamel is apparently good, it pays to scrape it off. This can be done with a knife and fine emery, finishing with buff (keep the disk clean so that it amalgamates regularly when put into mercury). If the meter has been in damp situations rust may have started to form on poles under the paper in the bath; if so clean off and reinsulate with shellac or voltalac, as continuation of rusting will pierce paper and short-circuit the meter. Examine top jewel for endplay and freedom.

For meters such as those above, in which the constant is quickly changeable, it is not always possible to carry a sufficient stock of change wheels and pinions, or change wheels and worms. An alternative combination can usually be found by working out the ratio between the two multiplied by the corresponding meter constant, the figure obtained being a *train* constant for the remaining tables at the same voltage. Thus with Ferranti tables: $A/B \times k$ equals 313 for 230 volts. So if K is the constant desired (15.4) and a 61 wheel and a 30 pinion are not available, and perhaps a 50 pinion is in stock, then as $A = 313/K \times B$, $A = 102$ approximately: the true value of K for this wheel and pinion being 15.35.

Electrical Apparatus Co.—Commutator motor meter. Constant in revs. per unit. Adjustments are made on the main circuit coil, or on the position of the magnets.

Stock desirable: A set of jewels, two types, several pairs of brushes, terminals with their micanite bushes and washers, several armatures, and a balance to check brush tension.

When overhauling, special points requiring attention are: Train friction, commutator, jewel and pivot (apparently very liable to rust), position of commutator with reference to armature windings, brush tension light and equal. It is advisable and repays the time spent to give *special* attention to the surface of the commutator segments. Should the main terminals have been removed, it will pay to use a good varnish on the outside and inside of the bushes and under the washers to practically seal the terminal inlets, as with this type of meter owing to the warmth of the shunt, moisture appears to be drawn into these inlets. Short circuits due to corrosion will be found on the shunts in older types, but this trouble can be minimised by making the case as airtight as possible. If when reassembled the meter will run freely on 1/100 load, but the curve is too steep, it may be best to have the magnets remagnetised.

Landis and Gyr.—Commutator motor meter. Constant in revs. per unit on the smaller meters and in revs. per minute at full load on the larger and energy meters. No special tools required except balance to measure brush tension. Adjustments are made on the main circuit, which is easily accessible. On one class of meter there is no light load adjustment. The jewel is specially protected, which is not altogether an advantage, as it cannot readily be inspected. The worm on the armature shaft may cause trouble due to corrosion; a good feature appears to be the simple device to minimise damage in transit.

Calculations.—For meters whose constant (K) is stated in revolutions per unit.

T secs. = (3,600 × 1,000 × N revs.)/(volts × amps. × K).

Or T secs. $= 3{,}600/V$ when $N/A = K/1{,}000$.

To obtain a suitable figure for N and a whole number for the revolutions in N secs., the following values are suggested:—

Volts	T secs.	N/A Revs./Amps.
50	72	K/1,000
70	51.43	—
100	72	K/1,000×2
110	65.46	—
120	60.0	—
150	48.0	—
200	72	K/1,000×4
210	68.57	—
220	65.46	—
230	62.61	—
240	60.00	—
250	57.6	—
400	72	K/1,000×8
440	65.46	—
460	62.61	—
480	60.0	—
500	57.6	—

Example of use: Meter labelled 5,000 revs. per unit, supply at 210 volts. Count N/A = 4 K/1,000, or 20 revs. per ampere in 68.57 secs.

Error %	FAST. 8	7	6	5	4	3·5	3	2·5	2	1·5	1	0·5	T 0	SLOW. 0·5	1	1·5	2	2·5	3	3·5	4	5	6	7	8
For Meters marked Revs. p. Min.	55		56	57			58			59			60				61			62		63		64	
	·2	·8	·4	·0	·6	·9	·2	·5	·8	·1	·4	·7	·0	·3	·6	·9	·2	·5	·8	·1	·4	·0	·6	2	·8
For Meters marked Revs. p. Unit	44		45		46				47				48					49				50		51	
	·16	·64	·12	·60	·08	·32	·56	·80	·04	·28	·52	·76	·00	·24	·48	·72	·96	·20	·44	·68	·92	·40	·88	·36	·84
	47		48		49			50					51				52				53		54		55	
	·31	·83	·34	·86	·37	·63	·89	·14	·40	·66	·92	·17	·43	·69	·94	·20	·46	·71	·96	·22	·48	·00	·52	·03	·54
	52	53	54		55			56					57		58			59				60	61		62
	·99	·57	·14	·72	·30	·58	·87	·16	·45	·74	·02	·31	·60	·89	·18	·46	·75	·04	·33	·62	·90	·48	·06	·63	·21
	55		56	57			58			59			60				61			62		63		64	
	·2	·8	·4	·0	·6	·9	·2	·5	·8	·1	·4	·7	·0	·3	·6	·9	·2	·5	·8	·1	·4	·0	·6	·2	·8
	57	58		59	60			61					62		63			64			65		66		67
	·60	·23	·85	·48	·11	·42	·73	·05	·35	·67	·98	·30	·61	·92	·24	·56	·86	·18	·49	·80	·11	·74	·37	·99	·62
	60		61	62		63			64				65		66			67			68		69	70	
	·22	·78	·43	·19	·84	·17	·50	·82	·15	·48	·80	·13	·46	·79	·11	·44	·77	·10	·42	·75	·08	·73	·39	·04	·70
	63		64	65		66			67				68		69			70			71	72		73	74
	·09	·77	·46	·14	·83	·17	·51	·86	·20	·54	·89	·23	·57	·91	·25	·60	·94	·28	·63	·97	·31	·00	·69	37	·06
	66		67	68	69			70		71			72			73			74			75	76	77	
	·24	·96	·68	·40	·12	·48	·94	·30	·66	·02	·38	·74	·00	·36	·72	·08	·44	·80	·16	·52	·88	60	·32	·04	·76

Example:—Standard time T = 62·61.
Time of N revs. counted = 61·05 ∴ error = 2·5% Fast.

THE SPIRIT OF GOODWILL IN ELECTRICITY SUPPLY.

By J. W. THOMAS, B.Sc., A.M.I.E.E.

The recent decision finally to disband the Joint Committee which was appointed by the National Industrial Conference in 1919, and the apparent change of attitude on the part of the Government to the formation of a National Joint Industrial Council, brings again into the foreground the question whether the schemes for the re-ordering of the industrial world on a more humane and satisfactory basis, which men set their hearts upon during the war, have borne the fruits that were anticipated.

It will be remembered that when the war ended in 1918, the industrial world was in a state of ferment, and most of the large trade unions were contemplating putting forward comprehensive demands for increased control of industry, and were loudly clamouring for a better standard of living and for drastic changes in the industrial system. Employers were slowly recognising that the principal breakdowns that occurred in industry were not due to the plant, but to what the retiring president of the I.E.E. described as "the unlubricated working of the human element," and on all sides it was felt that now peace had returned, employers must not, as in the far-off days, wrestle and fight with each other in order to secure a larger share of the products of industry, but must learn to foregather round a table and there discuss their common interests, and devise amicable means for settling their differences. The machinery that was to enable them to avoid strife came to be known as "Whitleyism." Its adoption was seriously advocated by the Government, and the fact that large numbers both of influential employers and employés threw their whole enthusiasm and energy into the task of setting the machinery in motion in the more important industries, was sufficient attestation that the promise of success was a fair one. There were, of course, a few who looked upon the advent of Industrial Councils with suspicion and misgiving, and said of them, as Dr. Johnson said of the intention of a friend who was about to be married for the second time, that "they registered the triumph of hope over experience."

Three years or more have now passed since that time, and the recent dissolution of the national body which, in the words of the Prime Minister, was "to inaugurate the new era in industry" tempts one to inquire into the practical results which have been achieved in the meantime, and to endeavour to assess their probable value in the future, particularly as regards the electricity supply industry. The general query was very ably put by a writer in the *Scotsman* recently:—

"What has the experience of departmental chiefs been of the Whitley experiment? Have they found that it has promoted efficiency, or improved harmony? Do they get better and more willing work from their subordinates? If not, has the experiment justified itself in one of the respects for which it was most cordially approved? The National Whitley Council was to decrease friction and increase contentment and, by removing misunderstanding and adjusting grievances, was to create an atmosphere in which better work would be done. If these results have not followed, the experiment has failed in a vital particular."

There are many cynics who would unhesitatingly reply that Industrial Councils have been an unmitigated failure; that they were a war-time product, and that, like munitions, they must now be relegated to the scrap heap. The melancholy Jacques, however, is always with us, and we need not take his cynicism too seriously. At the same time, few would go to the other extreme and assert that they have achieved all that was to be expected of them. That they have been able to harmonise the relations between employers and employed, particularly in public services, and that they have been the means of preventing the itching sores of our industrial system from breaking out into malignant ulcers, few will deny. But in spite of this, there is something which they have lacked, and it is that something which has prevented them from achieving such effective results as to silence the cynic. That something is wrong is evidenced by the recent secession of important municipalities, such as those of Hammersmith and Aberdeen, from the Industrial Council for the Electricity Supply Industry. Their action is no doubt due to their lack of appreciation of the possibilities that Industrial Councils offer, and partly to their desire to maintain control over their own staff, free and untrammelled by the bonds of any external authority. They have doubtless also been irritated by the decisions with which they have been deluged from what they consider to be some superior caucus in London, which will not allow them to carry on their work in peace. In a word, it is first because their own impression of the work of the Councils is purely a negative one as far as the assistance which they might render is concerned, and secondly, because they feel probably that these external bodies do not adequately represent them.

It will obviously be no solution of the difficulty to attempt to force these municipalities into line again and to impose upon them a scheme which depends fundamentally on good will for its effective working. If their attitude is to be changed, it can only be done by a frank and full discussion by both parties, and by resolutely facing the difficulties which have caused them to adopt their present outlook. They must, therefore, be given satisfaction on two issues, viz.:—

1. They must be convinced of the positive contributions which Industrial Councils can make towards assisting them both with regard to the harmony between themselves and their employés, and to the efficiency of administration.

2. They must be given adequate satisfaction on the question of representation.

With regard to the former, the probable reply of such a municipality as Hammersmith would be that its relations with its staff have always been harmonious, and that it does not require any external assistance to maintain that harmony. Even if such an assertion were made, we should be inclined to question its accuracy. There is in most municipalities an undercurrent of discontent, of which the average member of the Council is oblivious, and it only comes to the surface when the employés affected are able to make trouble. The non-occurrence of a volcanic eruption is not always a sure indication that the fires are not smouldering below.

But even were the statement true, allowance must be made for the new spirit which has come upon employés of all grades and classes, both manual and brain workers, and for the emergence of the desire for increasing control over the conditions of their working lives. The Whitley Report emphasised this, and more than a year ago the symptom was manifested at the annual conference of the National Union of Teachers, when a resolution was passed demanding "direct control of education by the teaching profession in partnership with the representatives of the public."

How the appearance of this new spirit is to be explained is of no consequence; it is there, and it will come to the surface. Nor will the demand of the employés be gainsaid. To try to crush it, or to ignore it, is to attempt to sit on the safety valve, with the attendant consequences when the explosion occurs.

There are many simple souls on councils and elsewhere who still believe in the good old days when the employer was the master, and when the employés were obedient and docile, and who think that those days will return if only the "agitator" and the "extremist" can be got rid of. But to believe this is to cherish a delusion as fatal as that of Canute when he endeavoured to check the progress of the advancing tide.

The desire of the employés for greater freedom must be recognised, and the latent forces possessed by their organisations welcomed and harnessed for the common good of the service, and of those who labour in it.

We can, of course, imagine the question being asked :— What difference will it make to the ordinary worker if he knows that he is represented through his organisation on a Whitley Council? The answer is that the difference will be manifested in the type of leadership, and will spring from the loyalty which he has to his organisation. He will feel that those whom he has elected have a say on any question which affects his particular work, and he will know that any innovations which are introduced have been discussed by them, and have met with their approval. The knowledge that there is always someone who can be relied upon to speak up for him and keep his end up will tend to eliminate the feeling that he is being imposed upon from above. His loyalty to his trade union will then be no longer an opposing force, but will be actively enlisted upon the side which endeavours to maintain the highest possible standard of efficiency that can reasonably be expected.

It is interesting to have the opinion of a reputed social psychologist like Prof. Graham Wallas on this point. In "Our Social Heritage," he says: "I have been for some years an elected representative of my fellow teachers on the governing body of my University, and I am convinced that my life and theirs is made better by the arrangement that representatives of the teaching staff shall influence university administration. I am also convinced that this benefit is not confined to the members of the particular occupation in which such a vocational element exists. I am more likely, as the world now is, to receive my letters and my coal regularly and conveniently if the unions of the postmen and the miners play a part in postal and mining administration: and the students of any university will receive better instruction if the organised teachers of the university help to govern it. Anyone who has worked in the hitherto unorganised occupation of journalism will feel that not only the personal happiness of the journalist, but the public good, would be increased if journalists belonged to a profession sufficiently organised to enable them to assert their self-respect against a bullying or corrupt proprietor. The feeling of human solidarity is so difficult to create under modern conditions that we cannot afford to leave unused for the purposes of social co-operation the unforced knowledge of each other, and the direct goodwill that may arise as an incident of common occupation."

Many municipalities have yet to learn that the primary value of Industrial Councils is that they help to generate a spirit of goodwill, and tend to remove that undercurrent of latent hostility which has hampered industrial development in the past far more than the effect of strikes. By dispelling the atmosphere of antagonism they enable both employers and employed to rise to the conception of combined action in pursuit of common interests, and so assist in laying the foundation for the consideration of constructive measures for the improvement of industrial conditions.

The spirit of goodwill amongst practical men is infinitely valuable, for it can find a way out of a difficulty where other methods fail. It has been proved again and again that regular contact breeds mutual understanding, and that when men meet round a table and work together for the good of an industry and of those who labour in it, a new sense of self-respect is created.

This goodwill, however, can only be the outcome of the recognition of common interests. Employers must realise that they are under an obligation to the community to endeavour to form a sympathetic understanding of the lives and outlook of those who carry on their work, and be willing to co-operate without dictation or patronage in every endeavour to improve the conditions of their working lives.

In a public utility service, such as the electricity supply industry, both employers' associations and trade unions must learn to regard themselves as joint trustees of one of the most important industries in modern life. But the above principles can only be impressed upon municipalities in so far as the trade unions are prepared to give up some of their defensive outlook, and to devote more time to the consideration of those problems relating to the industry itself, which still await solution. They must cease to look upon the electricity supply industry as the key which will open the door of escape when they are in a tight corner in another industry, and they must give up the idea that the appeal to force is the only remedy and the short cut to the realisation of their demands. In short, the employés must realise that they have a direct interest in the welfare of the industry, both as producers and as citizens, and that they stand to benefit both from its efficiency and its smooth working. The other problem is that of satisfactory representation. After June 1st, 1920, assertions were made repeatedly by various electricity supply authorities that they were not properly represented on the National Joint Board; that, in fact, it was purely an autocratic and self-elected body. When it was pointed out to them that they were represented through their constituent associations, such as the I.M.E.A., their reply was that they had not given a mandate to the I.M.E.A. to act on their behalf. This attitude was very general and, in the writer's opinion, it was largely responsible for the inefficiency of the Board. The system of having representatives from the various associations of employers was, of course, in accord with the recommendations of the Whitley Committee, but experience proved that it was far from being effective, at least in the electricity supply industry, where one has to deal with municipal authorities whose connection with their Association is much too loose.

It would seem as if the better arrangement is the one recently decided upon by the N.J.I.C. and the N.J.B., viz., that the municipal representatives should be chosen direct from the District Councils. As this involves a total of 26 representatives on the employers' side (13 from the municipalities and 13 from the companies), it might appear to be open to the criticism of making the national bodies too cumbersome and expensive, but it is not likely to prove so in practice, as it will be very rarely that all the representatives on the employers' side will meet together. Its great advantage will be that it will secure greater co-ordination between the district and national bodies, and will do a great deal towards ensuring that decisions of both will receive the assent of, and loyal acceptance by, the constituent undertakings.

Another difficulty which has seriously hampered the effective working of the N.J.B. has been the representation of the clerical staffs. For many months they have been the Ishmaels of the industry—refused admission on the N.J.I.C., presumably on the ground that the N.J.B. was supposed to represent them, and at the same time cold-shouldered by the N.J.B. A resting-place will, we hope, be at last found for them on the National Whitley Council for Local Government Officers, though we are not sure whether they will be comfortable there or not. The decision of the N.J.B. that in future only the technical staffs will sit on the employés' side may make the Board more acceptable to the municipalities, but it is not so certain that it will simplify the problems which may yet confront the Industrial Councils in the industry. The danger is that it may have the effect of restricting the scope of the Councils almost entirely to questions of wages and conditions of employment, and will make it almost impossible for them to deal adequately with those larger questions, to solve which Industrial Councils were called into being. Instead of the employés in the industry being sectionalised, it may soon appear that the time is ripe for a statesmanlike attempt to be made in the direction of establishing a National Industrial Council for the whole of the industry, and to include all those who are engaged in it, manual, technical, and clerical workers. Such an all-embracing body would be in a position to deal effectively with those larger issues affecting the industry, such as administration and efficiency, and would be able to render invaluable service when trouble was likely to occur. It would also carry much more weight than the present sectional bodies, and would probably gain the respect and adherence of those municipalities which at present are standing outside the movement.

The questions of wages and conditions of employment as they affect the separate sections of employés in the industry would be dealt with by separate boards or committees elected from the parent body.

If it were not considered advisable to have a separate board for the clerical staffs, provision could be made for their salaries and conditions of employment to be dealt with by the National Whitley Council for Local Government Officers, which would have a liaison connection with the Industrial Council. Such an arrangement would give the clerical staffs what they are justly entitled to, just as much as the manual workers or the technical staffs, viz., a voice on the Council dealing with the industry, whilst at the same time it would avoid the overlapping with the other departments of municipal administration which has been a fruitful source of confusion in the past.

The solution of the problem of representation is at the root of all good government, and once it is satisfactorily dealt with, and all those connected with the electricity supply industry have a voice on the Industrial Council, and are brought to an understanding of its usefulness, it will means a transformation in the spirit of one of those public services on the efficiency of which the community is so much dependent.

THE BRADFORD HOUSING SCHEME.

An Explanation by Messrs. Henley.

The advertisement of the Henley wiring system which has appeared in several issues of the Electrical Review has caused much comment, and, we believe, some doubts. It will be remembered that the advertisement stated that each wireman, with the aid of a boy, completed every day the wiring of two houses, each house containing nine lights. As some contractors seem to be sceptical about the statement, and as we put only the truth in our advertisements, we want to give an explanation of how it is done. Actually, the number of lights per house varies, there being seven, eight, nine, and ten, the two larger numbers predominating. But the number makes no difference to the rate of wiring, for the men wire two 10-light houses per day with the same ease as two 7-light or 8-light houses. This points to the fact that the men are making their own pace. Driving would not produce more, but the men have been known to do more on occasions.

In the first place, the organisation at the contractor's premises has something to do with the ultimate result. Everything is arranged and thought out beforehand, and the workmen get right away to work each day with a minimum of delay and on a pre-arranged plan, which obviates their stopping the actual work of wiring to "think things out." The wiring is repetition work, and each man gets through his job like an actor through his part, and according to plan. And each man is a *conscientious and loyal workman*, having his heart in his work.

It must be understood that the wiring is done while the houses are in more or less "skeleton" form, and before ceiling laths or plaster have been put in anywhere, but floorboards are fixed and slates are back pointed. Thus, there is no cutting away to be done of walls or plaster for the sinking of wires. Holes, however, have to be cut through walls and joists, and the wires threaded through them. The holes through the joists, which are $\frac{5}{8}$ in. and $\frac{3}{4}$ in., are bored at least $1\frac{1}{2}$ in. from the bottom of the joist to ensure that plasterer's lath nails do not reach the wires. All the wires radiate to the various points *via* three-plate ceiling roses. Porcelain connectors were used on the first batch of houses, but these are now eliminated. The present method uses a little more wire, but that is more than compensated for by the saving in labour. Thus all wiring is buried under the plaster, and at switch points it is protected by a short length of our S.T.3 protective covering.

Erection of fittings is not included in the time given. In order to ensure the best possible insulation test, the ends of the cable, after baring or preparing, are treated with a good insulating varnish to exclude moisture until such time as the houses are plastered, after which another equally conscientious workman erects the fittings and completes the work. The average test is about five megohms for each house. The working day is $8\frac{1}{2}$ hours, but from this must be deducted approximately $1\frac{1}{2}$ hours taken in travelling, so that the actual work of wiring two houses is done in about seven hours. Further, materials, tools, and scaffolding have to be removed from the last house wired to the next ready for wiring, which may be three or four hundred yards distant. This takes up considerable time.

The average number of lights per house is nine, each light being controlled by a separate switch.

The fusing arrangement on the consumer's side consists of a pair of 5-amp. porcelain plaster-lined cut-outs with a 5-amp. linked switch. The internal wiring consists of 3/.029 in. our class Z.Z.M.F., and the main from the meter to the switch is 7/.036 in. our class Z.Z.M.F. Three-plate ceiling roses are used for looping, and all the metal sheathing is very carefully bonded with standard clips, and earthed. Over 250 houses have been wired, and there has not been a single case of a low insulation test.

The contractors are Messrs. Jessop & Boydell, Ltd., of Bradford and Manchester, and to their enterprise in organisation, their skill in training, and the personal power which generates such a spirit of good-will in their workmen, the highest praise is due. The use of the Henley wiring system helped very considerably towards this highly satisfactory result, by facilitating the organisation of the work and the speed at which it was carried out.

This article has been submitted to Messrs. Jessop and Boydell, Ltd., before being sent to the Editors of the Review, and they confirm everything in it. Moreover, their workmen are quite willing to give practical demonstration that the statements are correct, and that the work is done—and properly done—at the rate given.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A New Speed-reducing Gear.

The need for a simple and direct device for reducing the speed of a motor by any desired ratio without loss of efficiency has been but partially met by the expedients with which we are familiar, and therefore the "concentric speed transformer," which has been developed by Messrs. Bostock and Bramley, of Netherton, Huddersfield, should meet with a cordial welcome. As indicated by its title, the driving and driven shafts are collinear; the "transformer" is self-contained, and is preferably coupled to the motor and the load through flexible couplings, which are also made by this firm. The speed ratio may be anything from 3 : 1 to 1,000 : 1, and even higher.

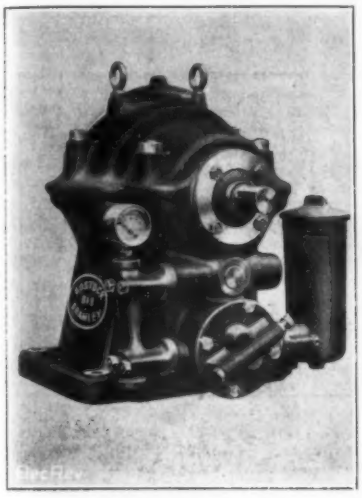
From the accompanying illustrations, it will be seen that the gear is of the planetary type, and that there are no small pinions or large wheels; the larger the gear ratio, the more closely alike are the pitch diameters. Referring to fig. 4, a vertical section, the gear planets E and F are carried by heavy steel plates bolted to the driving member C. The planet E engages with the fixed sun wheel A, this member being rigidly keyed to the gear case casting. The planet F engages with the driven gear wheel B. All gears are made from high tensile heat-treated steel, their teeth being cut by a generating process.

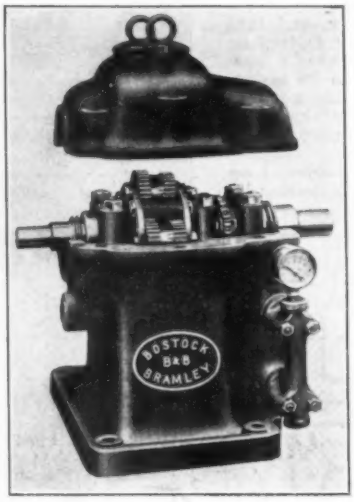
The planets E and F are in one piece, with no keyways or loose parts. Four sets of planetary gears are used for standard work, thus neutralising the transverse thrust of the gears, and these are mounted on heavy type Timken roller bearings.

The three main bearings are lubricated, under pressure, through the passages marked H, whilst oil is also forced, under

pressure, on to the teeth of the gears. There is no splash lubrication and no power lost through the unnecessary churning of a bath of oil.

The oil pump is driven by a chain, and the oil passes through a filter, seen at the right-hand of fig. 1. The main





FIGS. 1 AND 2.—CONCENTRIC SPEED TRANSFORMER.

bearing caps are independent of the top cover, which can be removed without disturbing the mechanism. Any of the planet pinions can be removed without disturbing the shafts, and the filter can be removed for cleaning while the gears are in motion. The oil pump can also be withdrawn easily. No

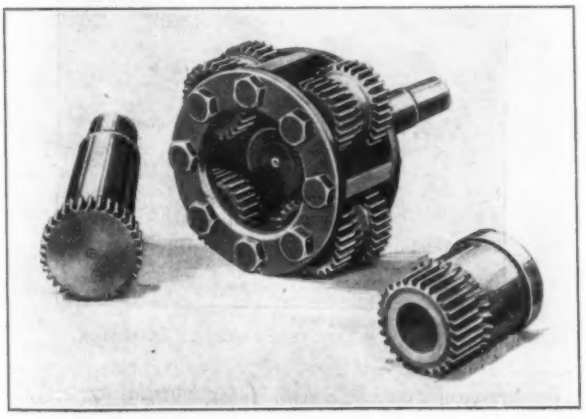


FIG. 3.—THE GEARS DISASSEMBLED.

attention is necessary beyond the addition of oil at long intervals.

The sets are made in seven sizes, to transmit from 10 to 250 h.p. (reckoned at 1,000 r.p.m. of driver, and a gear ratio of 5 : 1).

Safety Switch for Overhead Cables.

A correspondent informs us that he has invented a safety switch to cut out bare overhead cables, or tramway trolley wires, which has no parts to break, while the wearing parts are renewable and all parts are interchangeable. It can take up slack wire, and is operated by gravity. He claims that a broken line could be repaired, even by a tramcar conductor, in a quarter of the time now taken, and inquires whether there is a demand for such a device. Perhaps readers interested in this subject will give their views.

"Isco" Loop-in Cut-outs.

MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Blomfield Street, London Wall, E.C.2, who have recognised the necessity for reducing house service costs to a minimum, have sent us details of their new "Isco" cut-outs. The looping-in system in which these are employed reduces underground jointing, an expensive item, to very small proportions. By means of only two service connections a number of houses can be supplied, as the "Isco" boxes are adaptable to practically any feeding arrangement. A block of houses can be supplied by one cable or fed from both ends similar to a ring main. In the latter case (where the supply is tapped off either a three-wire or three-phase, four-wire main), by isolating a loop between two houses, one tapping can be taken off the positive side and the other off the negative side, or off any

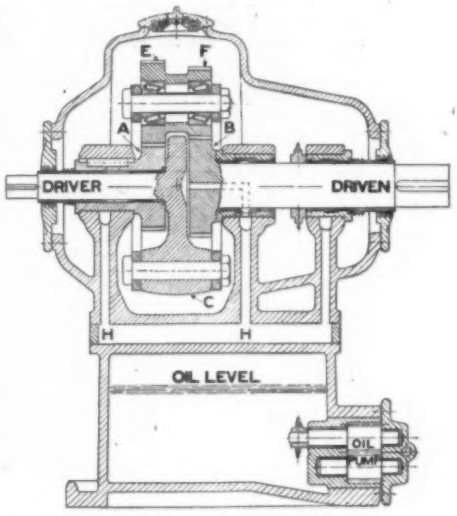


FIG. 4.—SECTION OF SPEED TRANSFORMER.

phase and the neutral. The balance of the system can be easily adjusted by altering the position of the links. As is the case with all "Henley" boxes, the entry of cables is efficiently provided for; ample provision for bonding is made; and armour grips can be fitted. The double-pole fuses are of the firm's standard H.O. pattern connected to the supply cable through special links which enable the supply of one house to

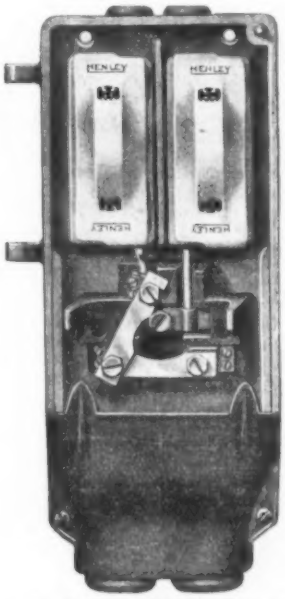


FIG. 5.—"ISCO" LOOP-IN CUT-OUT.

be disconnected without interfering with the supply to other houses. The illustration (fig. 5) shows the arrangement for two twin cables entering vertically, with sealing chamber, link chamber, and fuses. The outgoing leads can be taken through insulating bushes or conduit.

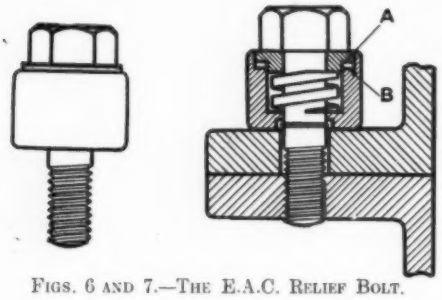
Flame-proof Mining Apparatus.

For years past the method to be adopted for rendering flame-proof electrical gear that is destined for use in fiery mines has been a vexed question, but a successful marshalling of the known facts has enabled the ELECTRICAL APPARATUS CO., LTD., of South Lambeth Road, London, S.W.8, to put forward the claim that it has solved the problem in an extremely simple fashion—namely, by the introduction of its patent relief bolt, as illustrated in figs. 6 and 7.

Stated briefly, the problem is this: the operation of most electrical gear, and certainly all switchgear, involves the mak-

ing and breaking of the electric circuit, which involves sparking, and in the event of an explosion occurring inside an enclosure containing electrical apparatus, it is essential to prevent the explosion from igniting explosive gases outside. This can happen in two ways: (*a*) The force of the explosion may rupture the enclosure and ignite inflammable gases outside, if no provision is made for relief. (*b*) Flames may be emitted through joints or openings in the case, or if an ordinary valve is fitted to relieve the rise in pressure inside the case, a spurt of flame may issue from the valve, and thus cause an explosion in the mine. The relief bolt comprises an ordinary bolt together with a spring totally enclosed in a dust-proof casing. The spring is under compression in its casing, and the latter is kept in position by a ring let into a groove in the bolt, so that the relief bolt forms a self-contained unit which cannot be taken to pieces, but is applied and used just like an ordinary bolt.

When used for holding a cover to its box, it is screwed up and the spring still further compressed until the indicating lip is flush with the cap. In this condition, a slight further compression is still possible, so that if the cover of a piece of apparatus is held on by relief bolts and an explosion should take place in the box, the cover will be allowed to lift slightly, and thus relieve the pressure inside, by allowing the products of the explosion to escape between the flanges of box and cover.



Figs. 6 and 7.—The E.A.C. Relief Bolt.

The cover is, therefore, in effect the relief valve, and the flames or hot gases which escape through the narrow space between the broad cold flanges of the box and cover are cooled to a sufficient extent to prevent the ignition of any inflammable gases which may be present in the mine.

The action will be obvious, but it should be added that the method has been tested by filling a box fitted with relief bolts with the most explosive mixture which can be met in a fiery mine, and placing the box in a chamber filled with a gas mixture of the most easily inflammable character. Under these conditions, the gas inside the box was exploded by means of an electric spark without causing any damage to box or bolts, and without igniting the inflammable gas outside. Relief bolts have been specially designed for mining use, but, of course, there are many other applications. The amount of movement can be varied and regulated, but having determined upon the amount of lift desired, the relief bolts are supplied so that the indicating lip is flush with the top edge of the collar when the bolt is screwed up to the proper amount. The function of the spring is merely to push back the cover after an explosion—not to resist the explosion. The thrust due to the explosion is taken by surfaces A and B, and unless otherwise specified, relief bolts are supplied to allow a lift of 1/32 in. They can be applied to any make of switchgear, and are supplied for use as set screws, or as bolt and nut. The following approximate figures will serve as a guide to the internal pressure required to lift a cover that is held on by E.A.C. relief bolts:—$\frac{3}{8}$-in. bolt=1$\frac{1}{4}$ cwt. per bolt; $\frac{1}{2}$-in. bolt =2 cwt. per bolt; $\frac{5}{8}$-in. bolt=3$\frac{1}{4}$ cwt. per bolt. Thus, a cover 1 sq. ft. in area which is held down by eight $\frac{3}{8}$-in. relief bolts will lift when the internal pressure rises to the equivalent of 8×1$\frac{1}{4}$ cwt.=10 cwt., or in terms of pressure per sq. in.= 10×112/144=7.7 lb. per sq. in.

A New Trolley Wire Insulator.

The use of trolley wires to feed electrically-driven travelling machinery is now accepted as standard practice, and since its inception the standard tramway suspension for carrying the trolley wires (composed of a phosphor-bronze line hanger carrying a bolt covered with a moulded insulation, the line ear being screwed on to the end of the bolt) has been used.

Fig. 8 shows one of these bolts and the carrier after a few months' use in a gas works, a short circuit having developed due to surface leakage between the line ear and the phosphor-bronze carrier.

After extensive tests, vitreous porcelain was found to be the only suitable material which would maintain its insulating properties when exposed to the weather and fumes which are common in towns, gas and chemical works, collieries, &c.; and knowing it would stand about 16,000 lb. per sq. in. in compression, an insulator was designed of suitable shape to be easily fixed in the place of the discarded standard suspension, with all strains mainly in compression, providing a long path to overcome surface leakage, due to rain and snow, deposits of soot, coal and coke dust.

The method of fixing can be varied to suit the structure which carries the trolley wires; fig. 9 shows one of these insulators mounted on the superstructure of a telpher track.

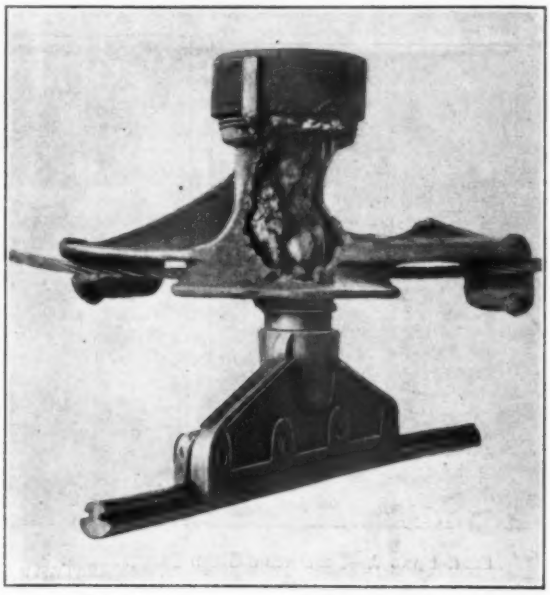


Fig. 8.—Old Type of Suspension Insulator.

The insulator consists of one piece of vitreous porcelain comprising in combination in a unitary structure a recess, receiving the head of the suspension bolt, which is covered with a non-hygroscopic cement, a groove being substantially vertically below the recess on which the bolt head bears, which is used for suspending the insulator with a " U " bolt or suspension wire. The bottom of the insulator is recessed to accommodate a nut on the bolt to take the strain of the trolley wire by any upward thrust on the bolt due to the trolley arm, which thereby comes upon the porcelain in compression.

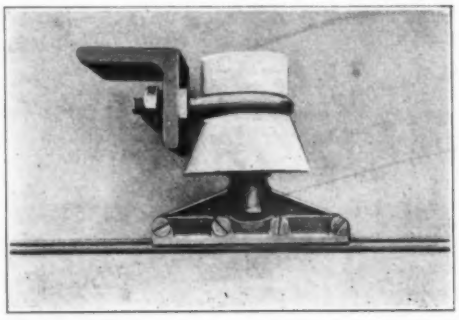


Fig. 9.—New Type of Suspension Insulator.

These insulators have proved successful on several of the largest gas works and coke oven plants in England; they are covered by patent No. 119,382, and may be obtained from the Benn Manufacturing Co., 36, Ladywood Road, Birmingham.

We are indebted to Mr. H. R. Lamb, A.M.I.E.E., of the City of Birmingham Gas Department, for the above illustrations and particulars.

Postal Parcels by Air.—The Postmaster-General announces that, in extension of the facilities already provided for the acceptance at certain post offices of parcels for transmission to Paris by aeroplanes, arrangements have been made for a second dispatch of air postal parcels on and from September 1st. The new dispatch will enable air parcels for Paris to be posted at certain post offices in London on the morning of dispatch, and at certain provincial towns up till a later hour overnight than is at present possible if connection is to be made with the existing dispatch. Delivery should normally be effected in Paris on the day of dispatch from London by either service.

ELECTRICAL VEHICLE RESULTS.

Bootle Corporation's Experience.

The Bootle Corporation's electric vehicle fleet consists of 13 vehicles employed on a big variety of local services. The machines comprise two 5-ton and two 3½-ton Electromobiles; two 5-ton General Vehicles, and seven 5- and 3½-ton Orwells. They are all tipping lorries, and the body capacity of the largest is 8½ cubic yards. I.M.V. batteries are employed.

Before considering the economical aspects of the Bootle electric haulage system, it should be pointed out that in arriving at the final working costs, liberal amounts were placed to the sinking fund, stores, depreciation, and loan charges, and these amounts were approximately equivalent to the cost of two new vehicles each year. Depreciation for batteries was calculated on a guaranteed life of two years, within which period a new battery is provided for, but, as a matter of fact, the Motor Vehicle Committee expects to get a life of two and a half or three years each. The Corporation funds benefit by the department to the extent of £740 for electrical power, £554 for rent, and £275 towards the treasurer's department, which, of course, would not accrue if this department were not set up.

Fig. 1.—Transporting Coal Electrically.

The fleet represents a capital outlay of £22,731, and the surplus on the trading account of £3,541 is equivalent to a profit of 15 per cent., after allowing for reserves. The net profit is given as £1,387, or 6 per cent.

In view of the fact that this is the first year's working, the results are regarded as very satisfactory, particularly as they were attained during a transition stage when the department had only temporary gear, *i.e.*, temporary charging facilities, &c., which proved expensive for the first few months' working.

A new type of switchboard was designed by the motor superintendent, and has effected a saving of about £500 per annum, and Councillor J. Scott, A.M.I.E.E., chairman of the committee, claims that this is one of the most efficient types of charging plant there is in the country. He points out that it must be remembered that the average time each vehicle was in commission was only 7.1 months, and up to June 30th

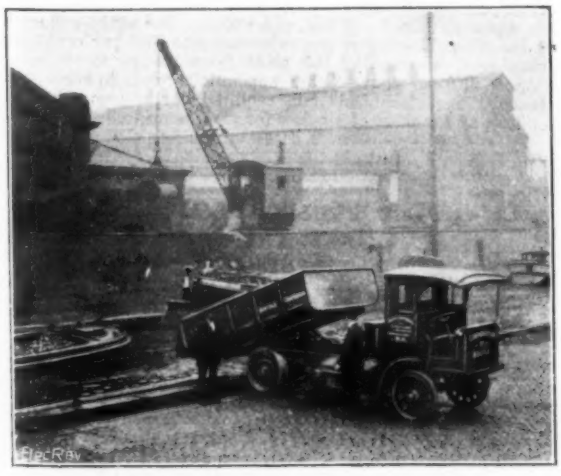


Fig. 2.—An Electric Refuse-collecting Vehicle.

the total tonnage weighed was 28,549, and the total mileage travelled was 24,552. Very careful records had been kept by the motor superintendent, which enable the committee to give the exact cost of the work done by the vehicles.

Mr. Scott has noted no published account regarding motor traction on corporation work that indicates that any town is doing better than Bootle, and he advances the opinion that if a rearrangement of the supervision and control of the men working in conjunction with the motors was made, with the fleet of vehicles the Corporation possesses, it would stand well to the front on running costs.

The Birmingham Corporation has a fleet of 32 electric vehicles, and tests have been carried out employing motors on the outer circle and horses on the inner circle. The motors travelled double the mileage of horses, and visited 2½ times the number of houses, showing a saving of £125 per annum on each vehicle.* The cost per house visit is as follows:—

Horse wagon (continuous system) working in the inner area, 3.22d. per house per week.

Electric vehicles, ditto, 2.94d. per house per week, showing a saving in favour of the electric vehicle of 0.28d. per house per week.

The committee advises the purchase of more electric vehicles when the financial position becomes easier.

The Bootle motor superintendent gave an opportunity to one of the leading makers of petrol vehicles to carry out some of the Corporation work, but they were warned that petrol vehicles were not suitable. The makers, however, were very sanguine that their vehicles would very easily do the work. The vehicle arrived with the head salesman and special testing staff, was loaded and sent to the tip, with the result that it sank into the soft ground and could not extricate itself. One of the electric vehicles was attached to the petrol vehicle, and easily pulled it out of the soft ground. It might be as well to mention that the petrol vehicles referred to were specially designed and built for corporation work. On the completion of the test the representatives of the firm agreed that the petrol vehicles were not suitable, and stated that they would not have believed it if they had not seen it for themselves.

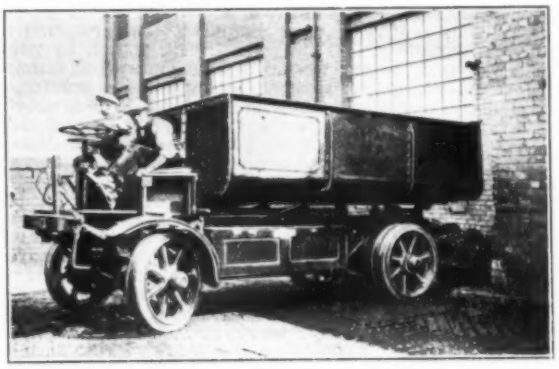


Fig. 3.—An Electromobile at the Bootle Electricity Works.

The total cost for horse cartage for 1920-1921 was 12.29s., against 9.6s. per ton for the motors. The increased cost of haulage was due to shorter hours, increased cost, and principally to the lack of co-operation.

Mr. Scott states without fear of contradiction that the motors could do much more work, and effect a very considerable saving to the ratepayers, if the whole of the men loading vehicles and collecting street refuse were put under the motor superintendent's charge. He quite agrees that there are certain jobs which can be done cheaper by horses than motors, but as they had the motors unprofitable jobs could be done in conjunction with other work, thereby reducing the cost of that particular work.

As regards street sweeping and gulley emptying work, the following comparative results are given: One motor (electric) and five men emptied 80 gullies per day at a cost of 2.18s. per gulley, against one horse and one man who emptied 16 gullies at a cost of 2.68s. It is believed that one electric vehicle would replace five horses on this particular work.

On street watering one electric vehicle carried 43 loads, covering 22 miles in one day, as against 22 loads for six miles by one horse. If a 900-gallon tank were supplied, as has been proposed, one vehicle would replace four horses on this particular work. On the Highway Committee's work the contractors' price is 6s. 6d. per ton from the docks; motors have carried out this work at a charge of £5 15s. per day, which works out at 5s. 7.66d. per ton.

* Elec. Rev., June 24th, 1921; p. 804.

A record was taken for the years 1920-1921 for seven weeks, during April and May of each year, on the collection of house refuse, with the following results:—

In 1920 14 horses were used and three electric vehicles; the total tonnage removed was equal to 37 tons per horse per week, and 67 tons per motor per week.

In 1921 six electric vehicles and two horses were used with the following results: 73 tons per motor per week, and 26 tons per horse per week.

On street sweepings, shop refuse, and gulleys in 1920 14 horses were used, equal to 6.7 tons per horse per week. Shop refuse, 2.28 tons per horse per week. Gulleys, 45.4 cwt. per horse per week. In 1921 three electric vehicles were used as follows: Street sweepings, 23 tons per motor per week. Shop refuse, 10.4 tons per motor per week.

On the Sanitary Committee's work it has been found that one electric vehicle is equal to from three to five horses. The average load of horses was 25 cwt., and on one week's average, the following details were ascertained, showing the comparative costs:—

Thirty-three horses removed 174 loads, total weight 236 tons 18 cwt., at a total cost of £82 17s., or 7s. per ton.

One motor removed 36 loads, trailers 18 loads, a total weight of 156 tons 14 cwt., at a total cost of £31 12s., or 4s. 9½d. per ton.

All these costs are based on 32s. 10d. for horses per day, and £5 15s. per day for motor vehicles; that is, the cost to the committees concerned, and not the motor vehicle department's net cost.

In conclusion, reference may be made to the accompanying illustrations which show three electric lorries carrying slack coal to the electricity works (fig. 1), refuse being tipped into a canal barge (fig. 2), and an Electromobile vehicle (fig. 3) that is also engaged in conveying coal to the electricity works.

DUST REMOVAL EQUIPMENT.

In connection with the discussion on the technical aspect of vacuum cleaner design which has been proceeding in our columns, our attention has been drawn to a paper entitled "Dust Removal Equipment as Applied to Residences, Offices, Public Buildings, &c.," which was read before the Institution of Heating and Ventilating Engineers (Incorporated) by Major R. Grierson, in February last. The author, by virtue of his position as engineer to a large undertaking owning many kinematograph theatres throughout the country, is naturally interested primarily in the type of dust removal equipment which is adapted to the requirements of large public buildings, usually involving the installation of stationary power-driven exhausters at a central point, connected with a system of piping laid to all parts of the building and provided with hose inlets at suitable points. Much of the paper, however, relates to features which are common to all applications of the vacuum cleaner, and the author believes that it is the first paper presented to a British Engineering Institution on this subject, which, as he truly remarks, has not yet been placed on a satisfactory scientific basis.

The author divides the equipment into two broad classes: Carpet cleaning (including tapestry, chairs, curtains, &c.), and bare-floor cleaning, including walls, &c. In carpet cleaning it is possible to obtain more or less intimate contact between the carpet and the cleaning tool, and hence to maintain a relatively high degree of vacuum inside the tool. On the other hand, in floor cleaning, it is not possible to obtain a tight joint between the tool and the surface to be cleaned, and a high degree of vacuum is not employed.

Dealing first with the former, the author points out that almost every type of carpet offers very considerable resistance to the passage of air, necessitating a considerable vacuum within the cleaning tool. Glue-sized-back carpets are practically impervious to air, which must, therefore, pass through the pile; in cleaning curtains a large proportion of the air passes through the fabric.

From the consideration of fundamental principles the author draws the conclusion that when intimate contact can be obtained between the surface to be cleaned and the cleaning tool, a fairly high degree of vacuum should be carried and a small quantity of air should be used, at a high velocity. These conditions also tend to permit of the minimum sizes of pipe and minimum energy losses. In bare-floor cleaning a relatively small vacuum will induce the flow of a large volume of air. In this connection he points out that experienced cleaners paid on the piece-work basis for carpet cleaning invariably select the smallest available cleaning tool, in order to obtain a high vacuum and high air velocity, although the labour involved in covering a given area with a small tool is greater than with a large one.

Turning to details, the author recommends that the "renovator" (the fitting placed in contact with the surface to be cleaned) should not be longer than 12 in.; for average work the slot may with advantage be 5/16 in. wide, and not more than ⅜ in. A wide slot allows the carpet, if not too stiff, to rise slightly into it, thus loosening the dust. The lips of the renovator should not be too sharp, otherwise the tool will sink into the carpet, involving additional labour and undue wear on the carpet. Efficiency tests must be made on naturally soiled carpets, as figures obtained from carpets artificially soiled have been found to be very unreliable.

The effort required to operate a 12 in. x 5/16 in. renovator with a vacuum of about 8 in. mercury on a "Brussels short" or "velvet with glue" carpet has been found to be 18-20 lb., with an expenditure of about ¼ h.p. at the renovator. On linoleum, with a vacuum of 13 in., the pull was 23 lb., and the power consumption 0.35 h.p. Generally speaking, a vacuum of at least 2 in. mercury is necessary to do even fair work, and 4 to 4½ in. for first-class work, but it should not exceed 5 in. The width of slot should be greater than the height of the nap of the carpet, and the wearing surface of the tool should be of steel or cast iron. For bare-floor cleaning a felt-faced tool is useful. The handle, through which the dust-laden air passes (with a piping system) should not be less than ¾ in. bore or more than 1¼ in. for a carpet cleaner, and not less than 1½ in. for a bare-floor cleaner. Steel is desirable for the handle, to resist the cutting action of the dust, and right-angle turns must be avoided. The hose is generally 25 or 50 ft. long, 1 to 1¼ in. bore.

Many details regarding hose inlets, piping, &c., are given in the paper. The size of pipe should be such that the air velocity is not less than 2,400 or more than 9,000 ft. per minute, and care should be taken to avoid pockets in which dust can collect, and to provide means of cleaning the pipes at any time. Risers should not be less than 2 in. in diameter.

For separating the dust from the air, a combination of an efficient centrifugal or gravity separator and a bag of liberal proportions is recommended; a good centrifugal separator will remove 95 per cent. of the dust.

Various types of exhausters are available, but the ideal machine has yet to be devised. Rotary pumps of the Roots type have the advantages of minimum wearing parts, low speed, quiet running, and economy in first cost and maintenance, but the load on the motor is greatest when no hose inlets are connected. Centrifugal fans keep a fairly constant vacuum, but have to run at a very high speed.

The paper concludes with a section on selecting and testing plant. Three classes of work are considered: Bare-floor work (½ to 2 in. vacuum), ordinary carpets, &c. (1½ to 3 in.), and heavy carpets (3 to 5 in.). The plant is rated on the basis of two of the following items: Volume of free air, vacuum within the renovator, or equivalent working orifice of the renovator. The first and last of these are connected by the formula: $Q=66\ A\sqrt{h}$, where Q=cubic ft. of air per second, A=area of orifice in sq. in., h=head of mercury in inches. Thus, from a table, we have for a residence an equivalent working orifice of ½ in. for carpets, a vacuum of 2 in., air-flow 18 cu. ft. per minute, and a consumption of 57 watts. For a large office, using the same orifice, a vacuum of 4 in. gives an air-flow of 26 cu. ft. per minute, and a consumption of 165 watts. A portable type, with equivalent orifice ¼ in., and a vacuum of 1 in., gives an air-flow of 20 cu. ft. per minute with a consumption of 32 watts.

A convenient instrument for testing is described, and the following formula is given connecting the volume of air in cu. ft. per minute (V), corrected for pressure, with the vacuum in inches of mercury at the point tested (P), and the power expended in watts (E):—

$$E=1.59\ VP.$$

This expression enables figures to be obtained for the power developed at the renovator, the losses in each section, the efficiency of the exhauster, and the overall efficiency of the plant.

A specimen test of vacuum cleaning plant is appended to the paper, from which we gather that the vacuum at the orifice was 4⅛ in., at the hose inlet 5 in. (50 ft. of hose), at the separator (125 ft. of 2-in. pipe) 5⅛ in., and at the exhauster 6½ in. The efficiency of the exhauster was 51.2 per cent., and the overall efficiency of the plant (motor input to renovator output) 21.6 per cent. Other appendices relate to a proposed standard test, technical data required for a comparison of tenders, and a chart of air-flow for various orifices and vacua.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

A Motor Problem.

With reference to your correspondent's inquiry under the above heading, I think the trouble is due to the machine being designed for 50 or 60 cycles. I presume it is a 6-pole machine, which would give an approximate speed of 500 revs. per minute, which is out of proportion for that size of machine. I shall be pleased to give Mr. Davies any further information he may require or test the machine for him on a 50-cycle circuit.

A. C.

September 3rd, 1921.

It is very evident from the letter of Mr. Davies that he has had very little experience with a.c. motors. According to him the motor is not provided with a name-plate—"absolutely no

information," to use his own words. He next informs us that the h.p. is 0.5. How did he discover this, or that the motor is suitable for 230 volts?

It is fairly certain that it was designed for a periodicity of something in the neighbourhood of 60 or 80 cycles. An induction motor having 6 poles and run on a 25-cycle supply would only have a speed of 500 r.p.m., less the slip.

It is impossible to have the motor wound to run on 25 cycles without materially reducing the horse-power, as being designed for a much higher periodicity, there will not be sufficient iron in the stator. Again, it is very doubtful whether there will be enough clearance between the stator and the end-shields to get, say, a 2-pole winding in.

I would suggest that Mr. Davies should take his motor to some firm of winding specialists, of whom there are several, and have the winding re-designed.

Robert Swindlehurst.

London, S.W.
September 3rd, 1921.

A Question of Sincerity.

You will perhaps be interested in the cutting attached.

When I read the sentence in your issue of August 19th, I thought how little the writer of it really realised what his words implied, and how little importance his readers would attach to them. Otherwise those words would never have been written.

It occurs to me that in electrical, or any technical matters, words in your journal really mean what they appear to mean, but when your writers touch on matters sociological, there is no need for truth—cold scientific truth—and the ordinary careless conventional phrases will suffice. . .Anything will do!

I challenge you to assert, in your next issue, that you really mean that ALL should work—all who are capable—not their hardest (which is an absurd proposition), but that they should work fairly hard.

F. W. Shorrocks.

P.S.—Are you aware of the number of able-bodied parasites in this country in normal times?

London.
September 2nd, 1921.

[The cutting referred to reads as follows:—

Here's more evidence of the Bolshevik conspiracy to compel the idle rich to work:—

From the Electrical Review of August 19th, 1921 (leading article):—

"What we ought *all* to be doing now is *working our hardest* and bearing whatever sacrifice is necessary, in order to keep alive the industry by which we live."—*The Forward*, Glasgow.

We really mean that ALL should work; we mean just what we said. Why should we not?—Eds. Elec. Rev.]

Flickering Light.

In a works taking a 25-cycle bulk supply for power and lighting I, personally, find that the flicker is quite noticeable with vacuum-type lamps, but is rather less pronounced with gasfilled bulbs.

However, from inquiries made in the shops, I have come to the conclusion that there is a certain amount of personal element in the matter, as some men seem to find the light more trying than others.

I should imagine that the continual flicker, however slight, would be very bad for the eyes, especially when doing close work such as tool making, &c.

Stuart F. Philpott.

Birmingham.
September 1st, 1921.

Supply Without Statutory Powers.

I should be very glad of information, if it is available, as to the probable attitude of those who will control the supply of electricity in the various districts under the new Act, towards the many unauthorised undertakings which have sprung up of late years.

The people interested in these small plants have in many cases provided a welcome supply of current since years before the new Act was contemplated, in districts where the local authorities would not move, and some of them are now naturally anxious to know their probable fate. I can find nothing in the Act which seems to me to apply in these cases.

I take it that strictly they have no *locus standi* at all, and that the moment a supply becomes available under an order obtained by the local authority they must clear out and sell their tackle for what it will fetch.

At any rate, information from someone with knowledge would clear the air for those interested, and perhaps save them some useless expenditure in the interval between the present time and the introduction of a statutory supply.

By the way, I should like enlightenment on the merits of the claim for cheap power supply under the new conditions. In this district, for instance, I believe contracts are being made between local authorities and a hydro-electric company on the basis of 1¼d. per unit delivered at the authorities' boundary. They must, I think, stand the expense of transforming down, and certainly of distribution. In this event, is 2¼d. too high an estimate of the final cost to the consumer? If not, the cost per h.p.-hour is over 2d. at 90 per cent. efficiency.

But, with a small and very simple high-compression paraffin engine, starting from cold, a h.p.-hour can be obtained on about half a pint. This at 1s. 4d. a gallon (some was bought here at 1s. 1d. the other day) costs 1d.!

I leave the crude-oil engine out, and take a class of engine which is cleaner in running, and is being sold to-day in sizes as low as 5 h.p.

The electric motor has undoubted advantages in the way of cleanliness, compactness, and general handiness, especially for intermittent use, but the claim of cheapness, even in small powers like this, *at the price mentioned*, seems to require substantiation.

A. O. G.

September 2nd, 1921.

[We refer to these questions in our leading columns to-day.—Eds. Elec. Rev.]

Trade Terms and Direct Trading.

I was very pleased to read "Half What's" letter in the current issue of the Electrical Review.

I recently had a customer in—a motor engineer who ordered up a special voltage lamp I got these, but when I produced the account showing list prices I was met with: "I get 20 per cent. off list price from ——." I looked up the "E.L.M.A." list, but was unable to find his name. I pointed out to him that I was unable to sell to him at less than listed prices. As I know him very well he paid the price.

I communicated with the firm he told me he got discount from, and much to my surprise they wrote me and informed me that my customer's statement was correct, and that I should be quite in order in allowing him a discount. I do not propose to do this, as when one has to pay postage on all lamps that prove faulty, there is not much got out of it.

There is one firm in particular which makes a practice of giving trade discount to those not one bit interested in the electrical profession. I think it is time that the Electrical Contractors' Association studied their members in other ways than by approaching firms of certain repute to give extra discounts to their members. Many of these firms are not even patronised by the members.

M. F.

September 3rd, 1921.

The E.P.E.A. Schedule and Economy Stunts.

As a demonstration of splenetic vehemence, the letter of "Anti-Bunkum" in your last week's issue has its points. He lashes himself into a fine frenzy of scorn and indignation, and punctuates his diatribe with a profuse array of exclamation marks over what he is pleased to characterise as the "bragging letter" of the E.P.E.A.'s General Secretary.

And yet, it seems to me, he misses the entire point of the latter communication, which, as I read it, was intended as merely an emphatic restatement of the principle for which the Association has always stood, viz., unwavering support of constitutional action for the adjustment of differences regarding salaries and working conditions of staff engineers.

In the two cases cited by Mr. Jones, this principle was directly involved and successfully upheld, and, if the upholding of it has produced the "disgust and contempt" of the Committees concerned, it is to be deplored—almost as much so as the tone adopted by "Anti-Bunkum."

This gentleman does not state whether he is a member of the E.P.E.A. or not. If not, his comments may be quietly ignored; if he is a member, his views, as expressed, are so antithetic to all that the Association stands for that his connection with it is quite inexplicable.

His fulminations would have been more effective had he possessed sufficient courage to sign his real name in place of a pseudonym. His example in this respect I do not propose to follow.

W. H. Simpson.

Manchester.
September 5th, 1921.

[Other letters in similar vein have been received too late for insertion.—Eds. Elec. Rev.]

A Warning to Contractors.

In April last I had a traveller call upon me representing a firm I had not previously done business with. I gave him an order. This was a cash transaction. A few weeks later I forwarded another order. Early in July the firm wrote me for a settlement. I replied that I would forward cheque in the course of two weeks. The account was for £20. The week following my letter I was served with a writ to appear in London, &c. The costs on this brought the account up to £30. I wrote to the firm, but my letter was ignored. I saw my solicitor, who took the case up, and would not agree to my paying in full settlement, as he informed me the plaintiffs' solicitors were "sharks," who were out for costs. He placed before them an agreement, which they accepted, namely, paying half the debt and costs on the 15th of the month, the balance on the 15th of the following month. Owing to the delay in post, my cheque was not received by the plaintiffs' solicitor until the 16th. On the 15th of the month a further summons was issued, and, naturally, further costs.

Now, Sirs, I call that a scandal. During the recent labour troubles business was dead, and there was absolutely no money coming in at all.

I had a case some time ago which I reported to my Association, who are supposed to look after their members' interest. (This is in their rules.) I was told that they could do nothing.

I suggest that the best method to adopt is to patronise old standing firms, and not shoddy factors. I should be glad to hear your views.

A Once Bitten Contractor.

September 2nd, 1921.

A Novel Sign.

The other evening, whilst standing outside the Harrow Coliseum, I observed a sign which read: "To the Tea Lounge." What drew my attention, was that the letters themselves were glowing, and apparently hanging in space. On examining them more closely, I perceived that the letters were enclosed in a bulb, shaped like the small "½-watt" lamps, and fitted with a bayonet cap. As far as I could see, only one wire led from the cap to the letter, and the other one terminated in a horizontal bar, placed very close to, and behind the letter. There was no filament of any description, visible, but each letter glowed with a pale, pinkish light. There was one complete lamp to form each letter.

I should be extremely obliged if someone would kindly explain the working of this lamp.

E. H. K. P.

August 30th, 1921.

[Probably the lamps were of the Neon gas type, which have no filaments, the gas itself being the source of light as in the Moore tubes. Neon tube lamps can be made in the shape of large letters and signs, glowing with a beautiful orange colour.—Eds. Electrical Review.]

Carpets and the Electric Suction Cleaner.

Your correspondence regarding the brushes as used on the broom type electric cleaners is interesting. For anybody to condemn either sort is foolish, for it can be proved that an electric cleaner can be made to clean carpets efficiently—

(1) without a brush;
(3) with a stationary brush;
(3) with a five-to-one gear-driven brush;
(4) with a belt-driven brush.

It is a proved fact that lint and tiny pieces of cotton are difficult to remove with suction alone from some types of carpets, and the brush just does the necessary and assists this operation. There is no need for a complicated belt-driven brush; it does no good and often creates a great deal of trouble, for the belts are sure to wear and break. Of course, there is always the possibility of damage being done by a brush revolving at 3,000 or 4,000 r.p.m. on a carpet. Try the experiment of placing underneath a belt-driven brush for ten minutes a piece of blotting-paper or underfelt, and note the results.

The "five-to-one" geared brush as used on the "Universal" cleaner is without a doubt the simplest and best. It creates the desired amount of resistance and performs its duty satisfactorily. It leaves the cleaning of the carpet to be efficiently carried out by the strong suction created by the fan connected with the guaranteed motor.

L. G. Hawkins.

London.
August 30th, 1921.

I am very pleased to see that we have at least one person who has the proper idea of vacuum cleaners, come forward in the interests of simplicity, and would respectfully point out that as an interested party in these matters she has struck the proper note.

Simplicity is the chief feature of the machine that I had in mind, but as I did not expect non-technical readers to take an interest in the Review it now becomes my duty to explain for the benefit of such readers that any purely "suction" cleaner is naturally simple.

Having no brush, it does not need anything but using and putting away; no brush to clean, no belt to adjust, no gears to see to—can anything be simpler?

The need of a powerful suction has been misunderstood; I only imply that the suction should be sufficient to do the duty, but on any machine with a brush you never find a good suction, hence the need of the brush.

I hope your reader will be satisfied with my explanation, but in any case, I shall be happy to be at her service on cleaner problems.

C. B. Oates.

London.
September 6th, 1921.

High-pressure Transmission Line Insulators.

Perhaps the following troubles I have experienced might interest your readers and afford me a way out of my difficulties.

Some time ago I completed 25 miles of 33,000-volt transmission line. This is continuous, anchored every mile on steel towers with pin insulators, and is through virgin jungle in rough country, with the usual lightning arresters at each end only.

Since it has been put in commission it has twice broken during storms, apparently from a direct hit about a foot away from a pin insulator on the outside wire. Arcing had taken place, as the line was marked for about a foot each side of the break, though the insulators were not damaged.

Moreover, the power station switch trips very often on overload. On more than one occasion birds have been seen to alight on an insulator, and on spreading their wings to take flight, have touched the tower and caused a short circuit. Quite a number of birds have been picked up by the inspectors underneath towers, burned.

I was on a 16-mile line in every respect similar to this, except that suspension insulators were used. In two and a half years I cannot recall a single instance of similar trouble.

This points to the unsuitability of pin insulators where there are birds with large wing span. Now, as pin insulators, especially on straight runs, are cheaper and more advantageous in every way, I would like to know if any firm manufactures a "ceiling" type suitable for the strain of line work. These fitted underneath a bracket would be protected from lightning, and would not offer a resting place for birds.

R. E. Golden.

London.
August 8th, 1921.

LEGAL.

Alleged Improper use of Electricity.

At the Dublin Southern Police Court, on August 29th, Miss Bolger, of Ranelagh, a lodging-house proprietress, was summoned by the Pembroke (Dublin) Urban Council on a charge of improperly using electricity supplied by the Council.

It was stated that a meter inspector visited the house and found that one of the slot meters had been altered in such a way that the full quantity used was not being registered. The inspector admitted that this must have been done by someone with technical knowledge. The defendant denied the charge, and the Magistrate considering the evidence against her insufficient, dismissed the summons, but without costs.

Excessive Tramcar Speeds.

At Scarborough, last week, W. Thomas and H. Dale, drivers of cars belonging to the Scarborough Electric Tramways Co., were summoned on charges of exceeding the speed allowed by the Board of Trade Regulations. The Chief Constable said as it had become obvious that cars were being driven down Vernon Place and Eastborough at a quicker pace than four miles per hour, the limit in such dangerous places, he had had observations and timing made. Thomas had driven over a measured 110 yards at the rate of eight miles per hour, and Dale had driven over a measured stretch at 8½ miles per hour. Defendants, pleading "Not guilty," said they had no idea they were going at such speeds. They had no speedometers, and it was difficult to judge speed. As they were the first cases of the kind the Bench dismissed the summonses on payment of 4s. costs, and suggested that, whilst the cases should be a warning to drivers, the Tramway Co. might give more particulars to help the men to keep within the speed limits.

Dust Explosions.—A bulletin recently issued by the United States Department of Agriculture asserts that all electric lamps in places where explosive dusts are present should be equipped with vapour-proof globes protected by heavy guards to prevent breakage. Dangerous practices, such as the use of open wiring, drop cords, and unprotected lights, are condemned.

It is believed that any combustible dust will ignite if allowed to collect on the lamp in sufficiently thick layers and remain long enough, probably due to the fact that the very chaffy dusts collected on the globe form a blanket which prevents radiation of the heat generated in the lamp and raises the temperature of the bulb to the ignition temperature of the dust. Some of the dusts seem to melt or congeal and form on the globe a crust which does not burn readily. During a recent campaign to prevent dust explosion about 20 cases were reported where explosions or fires were supposed to have been started by the ignition of dust which had settled on the lamp or by the accidental breaking of the electric lamp in a dusty atmosphere.

Under ordinary conditions, with the small lamps commonly used in industrial plant, and with free circulation of air about the globe, the specialists believe it unlikely that fire will start readily. They recommend, however, as just stated, that all electric lamps be equipped with vapour-proof globes.—*Electrical World.*

BUSINESS NOTES.

Bankruptcy Proceedings.—F. Barraclough, electrical and mechanical engineer, late of Eastcliffe, Lightcliffe, near Halifax.—Receiving order made August 30th on debtor's own petition.

J. W. Gladwin, electrical engineer, Sheffield.—First and final dividend of 8d. in the £, payable on September 12th at the offices of Poppleton, Appleby & Turner, 155, Norfolk Street, Sheffield.

S. H. Dougherty (Mersey Electric Co.), electrical engineer, Liverpool.—Last day for proofs for dividend September 21st. Trustee, Mr. H. W. Bowler, 30, North John Street, Liverpool.

Company Liquidation.—Sutton-in-Ashfield Motor and Electrical Engineering Co., Ltd., Sutton-in-Ashfield.—A meeting of the creditors of the above was held recently at Nottingham. Mr. J. Keetley, C.A., submitted a statement of affairs showing ranking liabilities of £5,404. Of that amount £1,668 was due to unsecured creditors and £3,736 represented an unsecured amount due on debentures. The assets were estimated to realise £15,416, from which had to be deducted £61 for preferential claims and £7,009 due to the first debenture holders. This left a balance of £8,346 to meet the claims of the second debenture holders, which amounted to £12,081. The balance was insufficient to fully discharge the claims of the second debenture holders, who were unsecured for £3,736. The assets were as follows: Cash in hand, £1; good book debts, £835; doubtful and bad debts, £715, estimated to realise £200; stock-in-trade, £839; tools, fittings, and utensils, £621; charabancs, lorries, and cars, £5,100; machinery, £746; freehold land and buildings at cost, £7,071; and calls in arrear, £2. The issued capital of the company was 5,226 preferred ordinary shares of £1 each and 525 deferred ordinary shares of 1s. each, or a total of £5,252. As regarded the contributories the deficiency was £10,656. The company commenced trading in November, 1919, and had carried on business at a loss. About a month earlier the bank, which held the first debentures, objected to the overdraft being increased, and as further moneys were not available, a receiver was appointed. The creditors decided to confirm the voluntary liquidation of the company with Mr. Keetley as liquidator.

Dissolution of Partnership.—Moffett & Rosher, consulting engineers, Union Chambers, Temple Row, Birmingham.—Mr. Noel B. Rosher has retired from active partnership, but retains an interest in the firm. Mr. Frank J. Moffett is continuing the work of the firm on the same lines as heretofore, the firm retaining its original title.

Trade Announcements.—The Engineering & Lighting Equipment Co., Ltd., has appointed Mr. R. Garmany, 1, Union Street, Belfast, sole agent for Ireland for the whole of its manufactures.

Messrs. Millns Electrical Co., of 17, Whitefriars Street, E.C., inform us they have been appointed the sole selling agents for Great Britain and the Colonies by Messrs. G. Meidinger & Co., manufacturers of motors, dynamos, alternators, &c., of Basle, Switzerland.

A. & A. Electrical Co., Ltd., of 13, Farringdon Road, state they have been appointed sole distributing agents for the De V. Y. F. Co., Doetinchem, Holland, manufacturers of two and three-phase a.c. motors.

Vincent Switchgear Manufacturing Co. have appointed as their agents for the whole of Scotland Messrs. Alston and Blyth, 97, Waterloo Street, Glasgow, who will carry stock of the Vincent switch and fuse gear.

The Jackson Electric Stove Co., Ltd., asks us to state that the address of its Scottish agent, Mr. Kirby Johnson, is 68, Gordon Street (not Gordon Road), Glasgow.

Catalogues and Lists.—The Edison Swan Electric Co., Ltd., Ponders End, Middlesex.—List No. G.G.212, "Industrial Lighting." In addition to a large amount of valuable data on the subject, this publication illustrates and describes very fully "Holophane" and numerous other reflectors, tube lighting systems, desk fittings, lanterns, &c. Views of actual installations in machine shops, shop windows, &c., are reproduced.

The Priory Electrical Engineering Co., Bath Street, Birmingham.—A blotter advertising "Priory" fuses, distribution boards and ceiling fittings.

Messrs. L. G. Hawkins & Co., 116, Charing Cross Road, W.C. 2.—Two folders—one illustrating and describing the "Universal" electric washer and the other dealing with the "Universal" electric radiator.

Messrs. Siemens Bros. & Co., Ltd., Woolwich.—An illustrated publication dealing with ebonite in all forms—sheets, rods, tubes, and mouldings. "Keramot," another insulating material is also described.

Aabacas Engineering Supply Co., Ltd., 44, Hamilton Square, Birkenhead.—Publication W.117, illustrating and describing horizontal, vertical, and universal milling machines of various types.

General & Electrical Repairs Co., Hill Street, Park Street, Bristol.—An illustrated leaflet dealing with the "Surshield" renewable enclosed cartridge fuse.

Heavy Current Electric Accessories Co., Park Road, Edmonton, N. 9.—A trade price list of switches, connectors, switch-plugs, and wall plugs and sockets. Illustrated.

The Stanton Ironworks Co., Ltd., near Nottingham.—Monthly list of cast-iron pipes. September.

The D.C.M. Tap Co., Ltd., 177, West Regent Street, Blythswood Square, Glasgow.—Two illustrated leaflets, giving prices, &c., of "D.C.M." taps in sizes ranging from 1/16 in. to 2 in. Whitworth, and B.A., British Standard pipe and British Standard fine threads.

The Chloride Electrical Storage Co., Ltd., Clifton Junction, near Manchester.—Circular No. 54, giving illustrations, details of construction, &c., of "Exide" accumulators for the control and operation of oil switches and high-pressure switchgear.

Millns Electrical Co., 17, Whitefriars Street, E.C. 4.—An illustrated list of motors, fans, blowers, transformers, &c., made by G. Meidinger & Co., of Basle.

The Waltham Manufacturing Co., 2, Jackson Road, Holloway, N.—An illustrated price list of "Waltham autolamps" for photographic and kinema work.

Messrs. S. H. Heywood & Co., Ltd., Reddish, near Stockport.—Publications No. 13, a well-illustrated descriptive list of electric lifts, winding engines, transporters, and cranes; and No. 14, dealing with control of electric cranes, showing in detail the "Heywood" resistance system.

The British & Allied Electrical Agency, Ltd., 13, Charterhouse Street, Holborn Circus, E.C. 1.—An illustrated and priced folder dealing with "Lowa" dimming switches of a number of types, including a special design for car headlights.

The Hastie Electric Water Heating Co., Ashley Street, Nottingham.—Two illustrated pamphlets describing the "Hastie" combined electric kettle and tea-pot.

The Lea Recorder Co., Ltd., 28, Deansgate, Manchester.—Booklet CM° on the "Lea" coal meter for attachment to chain-grate stokers, explaining its operation and application; and booklet C.T. on the measuring efficiency of the meter, giving particulars of two series of tests made this year, showing an accuracy of nearly 2½ per cent. in one case, and within 1 per cent. in the other.

Social Events.—The staff and employés of Messrs. J. H. Tucker & Co., Ltd., Tyseley, Birmingham, held their sixteenth annual outing on Saturday last, going by train to Evesham. The Sports Committee had arranged for the usual sporting events to take place in the morning, after which dinner was provided at the Town Hall. The after-dinner speeches included a vote of thanks to the directors and the Sports and Recreation Committee, proposed by Mr. G. Scrivener and supported by Mr. S. R. Davies. Mr. J. B. Tucker replied on behalf of the directors, and Mrs. J. H. Tucker distributed the prizes to the winners of the various sporting events. The afternoon was spent on the river and in the highways and byways and beautiful meadows for which Evesham is noted. Tea was provided at the Granville Hotel, and in the evening the party returned to Birmingham after a thoroughly enjoyable day.

Under the auspices of the Elliott Social Association the employés of Messrs. Elliott Brothers (London) Limited, of Lewisham, held their fourth annual garden fête and sports on Saturday last at the Colfe Grammar School Sports Ground, Eltham Road. The opening ceremony was performed by Mrs. W. O. Smith, wife of the chairman of the company. A long programme of events had been arranged, and some very keen sport was witnessed by a large crowd. Especially interesting was the departmental tug-o'-war, all the teams being very evenly matched, and a great final saw the test room beat the tool room by two pulls to one. In addition to the sterner events, the lighter side was well catered for, and much amusement was caused by the various comic competitions, while a number of events were reserved for the children. The prizes, which had been given by the directors of the company, were presented to the various winners by Mrs. L. W. Smith, the wife of one of the directors. At the close of the sports, dancing took place, the music being provided by the Lewisham Comrades Military Band, under the baton of Mr. E. R. Jennings (late K.R.R.). The arrangements for the meeting, which were admirably carried out, were in the hands of Messrs. W. J. Woodman, W. F. Beaden, E. J. Griffin, F. C. Hart, W. Nicolle, and A. S. Powell, while excellent work was done by the Ladies' Committee in providing light refreshments, &c.

The employés of the firm of Messrs. J. & W. B. Smith, Ltd., of 15-23, Farringdon Road, E.C. 1, held their annual outing last week, which was organised by the advertising manager, Mr A. Matton. They travelled by charabanc to Brighton, and reached their destination about mid-day. The weather was ideal, and an excellent programme was carried out.

For Sale.—By Direction of the Disposal Board, Messrs. Oliver, Appleton & Kitchen will sell by auction at the C.S. Depot, Barnson, near Leeds, on September 27th and following days, machine tools, plant, engines, boilers, electric motors, &c., and on October 12th and 13th, at H.M. Filling Factory, Coventry, Mr. C. B. Odel will offer by auction machinery and plant, electric motors, railway locomotives, timber, and builders' plant. Full particulars are given in our advertisement columns to-day.

Fusion of Swedish Telephone Manufacturing Companies.—An extraordinary meeting of the H. T. Cedergren Industrial Co. has resolved upon fusion with the L.M. Ericsson Telephone Co. by the adoption of a compromise proposal, according to which one share of the Cedergren Co. will be exchanged for eleven shares of the Ericsson Co. or Kr. 550.—*Reuter's Trade Service* (Stockholm).

Rail Shopmen's Wages.—The *Financier* states that an agreement has been reached between representatives of the railway companies and the Amalgamated Engineering Union regarding the wages and conditions of railway shop and shed workers. Under the terms of settlement a joint recommendation is to be made that the wages of all shop and shed workers be reduced by 6s. per week from August 15th. Further, arrangements are to be entered into forthwith between the representatives of the A.E.U. and the railway companies to discuss any outstanding rates of wages and conditions of service. This agreement is subject to ratification by the executive of the A.E.U. and the railway companies.

Irregularities in Tenders for Belgian Government Contracts.—The Commercial Secretary to His Majesty's Embassy at Brussels (Mr. B. P. Sullivan) reports to the Department of Overseas Trade that the Belgian Minister of Public Works has recently called the attention of the Administration des Ponts et Chaussees to the fact that tenders for contracts are frequently accepted in the interests of the Treasury despite the fact that they deviate from the prescriptions laid down in the specification in respect of the materials to be used. The Minister is, however, of opinion that if this practice becomes general miscalculations will result and a proper adjudication of public contracts will be made difficult. He has consequently directed that a clause shall in future be inserted in specifications to the effect that contracting parties are particularly reminded that any tender which does not conform with the prescription of the specification will be considered null and void. It is further stated that if irregular tenders are submitted despite this warning, it will be permissible to make use of them in the examination of similar undertakings.

Egyptian Government Contracts.—His Majesty's Commercial Agent for Egypt desires to call attention to the fact that contracts for the supply of goods to the Egyptian Government have been lost through the failure on the part of British firms to comply with the conditions of tender. These conditions stipulate that tenders can only be submitted by firms having a resident agent in the country, and that tenders should be accompanied by a provisional deposit of 2 per cent. of the value of the offer in money. This provisional deposit may be replaced by a letter of guarantee from an approved bank in Egypt, and does not, therefore, necessarily involve any outlay of capital. Copies of the general conditions of tender which form the basis of the conditions which apply to all public tenders, may be obtained on application at the Department of Overseas Trade together with a memorandum of information for the use of those United Kingdom firms which are desirous of submitting tenders for Egyptian Government contracts.

Dutch Electrical Imports.—The imports of electric material into Holland last year, according to a Dutch official report, were contributed by the following countries in the proportions named: Insulated cables and wire from Germany, 60 per cent. of the total, as against 30 per cent. from the United Kingdom and 10 per cent. from other countries. Motors and transformers, Germany, 50 per cent.; Switzerland, 17½ per cent. Measuring instruments, Germany, 70 per cent.

Catalogues Wanted.—The electrical engineer, Electricity Works, Hebden Bridge, wishes to receive catalogues and full particulars of large electric sirens or similar appliances to take the place of large steam whistles for fire alarm purposes.

Scottish Electricians' Wages.—The Electrical Trades Union is putting forward a counter-proposal to the demand of the Scottish Contractors' Association for a further reduction in wages. The union suggests a sliding scale agreement, while the employers propose a cut of 2d. an hour—1d. on October 1st and 1d. on November 1st. An early conference will be held.—*Glasgow Herald.*

The Norwegian Hydro-electric Co.—The Norwegian Hydro-electric Nitrogen Co. and its subsidiary hydro-electric works, the A/S Rjukanfoss, have concluded a loan for 50 million kroner with a syndicate of Scandinavian and French banks. At present the plant in operation represents 345,000 h.p., and a further 100,000 h.p. is available for future use. The proceeds of the loan are for the purpose of increasing the working capital.—*Financier.*

New Australian Electrical Company.—The prospectus has been issued of the Commonwealth General Electric, Ltd., which is seeking registration in Victoria. The authorised capital will be £750,000 in £1 shares, of which 550,000 will be offered to the public. The new enterprise is to acquire a Sydney electrical works, and by means of large extensions hopes eventually to secure a good proportion of the local orders for electrical appliances, including switchgear, transformers, turbines, dynamos, and many other articles needed in the Commonwealth. The total cost of the works and plant is estimated at £200,000. The company has also leased an area of 15 acres at Spotswood, a near suburb of Melbourne.—*Reuter's Trade Service* (Melbourne).

The E.T.U. and Theatrical Employés.—At the April Scottish Trade Union Congress a resolution was moved approving the action of a number of theatrical employés' associations in endeavouring to "unionise" every place of amusement in the United Kingdom. An E.T.U. representative endeavoured to pass an amendment including the name of the E.T.U. among the approving societies. The meeting apparently resented the intrusion of an electrical union, for the amendment was lost.

The general secretary of the National Association of Theatrical Employés states that the Parliamentary Committee of the Trade Union Congress, having heard both sides, consider that each union should retain its members, but that the N.A.T.E. is the proper body to cater for the kinema operators and not the E.T.U.

British Properties in Germany.—The *Bulletin* of the F.B.I. reminds members that October 1st next is the last day for submitting claims through the Enemy Debts Clearing Office for:—

(a) Proceeds of liquidation of property in Germany;

(b) Compensation under Articles 297 and 300 (b) of the Peace Treaty, in respect of damage inflicted upon their property rights and interests in Germany by the application of exceptional war measures, measures of transfer or of execution.

Claims for compensation received before that date, will be presented by the Controller to the German authorities, with a view to effecting agreements for submission to a formal judgment of the Mixed Arbitral Tribunal, thus obviating, as far as possible, the delay and expense of legal proceedings.

Claimants who are not yet in a position to furnish all the information necessary to support their claims, should send in forms giving general particulars and the total amount of compensation to which they consider themselves to be entitled on the information available.

Trade with Mexico.—The British Chamber of Commerce in Mexico City is forming a permanent exhibition of British wares, and manufacturers are invited to forward samples, catalogues, &c., for inclusion therein; the address is: Central British Chamber of Commerce, Apartado 900, Mexico, D.F.

The Italian Customs Tariff.—His Majesty's Consul-General at Milan (Mr. W. A. Churchill) points out that the new tariff which came into force on July 1st does not appear to be generally known or understood by United Kingdom firms. The effect of the high exchange and the high Customs tariff has been to bring imports into Italy from this country, in common with others, to a standstill. Exporters to Italy should therefore make careful inquiries as to duties and other points before shipping. The complete new Customs tariff appeared in the Board of Trade *Journal* of July 21st. The Department of Overseas Trade is prepared to render assistance to inquirers.

Celluloid Regulations.—The Home Secretary has drafted regulations relating to the manufacture and storage of celluloid and articles made of it, according to which stocks of celluloid must be kept in a special store outside the workrooms, and if more than 1 cwt. is stocked, the store-room must be constructed of fire-proof materials. Open lights and fires must not be used near celluloid, except to the extent necessary for manufacturing processes, and adequate means of extinguishing fire and of escape in case of fire must be provided. Objections to the regulations may be submitted before September 20th.

Lead Market Report.—Messrs. James Forster & Co., in their report of September 3rd, say:—Closing prices yesterday were £23 7s. 6d. for September and £22 15s. for December; there being no change on the week. The market has been remarkably quiet, Monday to Thursday (inclusive) transactions on the open market totalling only 650 tons, with practically no change in value from day to day. Arrivals in August were about 10,000 tons.

Reduction in Switchgear Prices.—The Ironclad Switchgear Co., Ltd., state that their prices are now considerably reduced; particulars can be had on application.

Trade with Italy.—In view of the difficulty of dealing adequately with calls for tenders by public bodies in Italy, when the tendering firm is of foreign origin, the question of establishing a native house for the purpose has recently been considered by the Commercial Counsellor to His Majesty's Embassy at Rome. In the opinion of the legal adviser to the Embassy, United Kingdom contracting firms might find it advantageous to consider the question of establishing branch houses ("filiali") in Italy, the directors of which can be either British or Italian. British firms which may wish to adopt the course suggested can obtain particulars as to the formalities necessary for registration and information on the taxation to which they would become liable on application to the Department of Overseas Trade, reference being made to D.O.T. 536/6/F.G.

Protection for the Glass Trade.—According to *The Times*, representatives of the operatives in the flint-glass section of the British glass trade have approached the Board of Trade with a view to obtaining protection from foreign competition under the Safeguarding of Industries Act, averring that unless steps are immediately taken to stop the flow of glassware from abroad, the industry in this country will be killed.

Book Notices.—"The *Journal* of the Institution of Electrical Engineers," Vol. LIX., No. 302, June, 1921, contains the following papers: "Some Recent Developments in Large Steam Turbine Practice," by K. Baumann; President's (Mr. Ll. B. Atkinson) address to the Western Centre; "Wireless in the Royal Air Force," by Major J. Erskine-Murray, R.A.F.

"The *Bulletin* of the Hydro-electric Power Commission of Ontario," Vol. VIII, No. 3, May-June, 1921.—This issue contains a report of proceedings at the June convention of the Association of Municipal Electrical Utilities, including papers on "Advertising," "Window Dressing," and "Sales Campaigns," with accompanying discussions. Two papers on "Safety First" principles and devices are also published. An illustrated progress report upon the Queenston-Chippawa development is included.

"The *Transactions* of the South African Institute of Electrical Engineers," Vol. XII, Part 7, July, 1921. Price 2s.—This part includes notes on "Recent Development in Steam Turbine Design."

"The *Journal* of the South African Institution of Engineers," Vol. XX, No. 1, August, 1921, includes a discussion on the method of cleaning wood-lined pipe columns.

"Gears in a Nutshell," by Capt. S. Bramley-Moore, M.C. (Bostock and Bramley, Huddersfield, price 3d. net), is almost sufficiently described by its title; it contains a set of "gear rhymes" for memorising gear formulæ, which are also given separately in the usual notation, for spur, helical, bevel, and worm gearing. A table of standard pitches, &c., is included, together with a pitch conversion table, making in all a very useful "kernel."

"The Practice of Electrical Wiring," by D. S. Munro. Revised edition, pp. xii+268; figs. 97. London: The Electrical Review, Ltd. Price 5s. net.

"The *Utrecht Fair Bulletin* of the Federation of British Industries," which has just been issued, is printed in Dutch and English, and contains articles by various authorities on the trade relations of the two nations, and on the facilities possessed by this country for supplying the industrial needs of Holland and the Dutch Colonies. Mr. C. H. Wordingham, C.B.E., contributes an article in Dutch on "British Engineering in Peace and War," and other writers deal with the value of experience in connection with narrow-gauge railways, mechanical power in cargo handling and harbour construction, and electric welding. The issue is intended for circulation at the Fair, which lasts from September 6th to 16th, and in the Dutch East Indies.

A Wireless Listening Station.—The private station of Messrs. Cunningham, Ltd., of 169/171, Edgware Road, is now in operation, and anyone is invited to inspect it and listen to the signalling and telephony—the latter being very clear. Mr. C. J. Close, late of the Government Wireless Service and Marconi's, is in charge, and at all times ready to give advice and assistance to amateurs.

Inquiries.—Makers of electric irons, &c., suited for 25-volt circuits are inquired for.

LIGHTING AND POWER NOTES.

Aberayron.—Electric Lighting Scheme.—The Urban District Council has decided to engage an engineer to advise on an electric lighting scheme. Mr. Eric Richards, of Lampeter, has purchased Llyswen Mill for the purpose of generating electricity for the town.

Belfast.—Consultants' Report Discussed.—At the monthly meeting of the City Council, on the 1st inst., the Lord Mayor presiding, Sir James Johnston, in proposing the adoption of the minutes of the Electricity Committee, said that a report had been received from the consultants, Messrs. Preece, Cardew & Rider. The committee had met that morning, but it had not time to examine the report, and had decided to ask that a special meeting of the Council in Committee should be held on September 22nd, if that would be a suitable date, for the purpose of discussing the whole question—not only the report, but many other matters in connection with the electricity undertaking. The question of the ordering of switchgear had been sent back at the last meeting of the Council, and the committee had decided to readvertise so that the matter need not come up for discussion. Councillor Oswald Jamison seconded the motion. Subsequently Councillor T. E. Alexander moved the resolution which stood in his name, regarding the consultants' legal responsibility (Elec. Rev., Sept. 2nd, p. 312). Various appeals were made to Councillor Alexander to postpone the motion, but he declined to do so on the ground that it was a matter of vital importance. He reviewed the position from the time that Sir John Snell assumed responsibility, beginning with the extension scheme at East Bridge Street, at a cost of £67,000; the installation of a 6,000-kW set; the £310,000 scheme of February 21st, 1918; the £600 air filter which, when delivered, was obsolete and useless (the company owuld not take it back). Mr. Rider, who came after Sir John, frankly stated that the original estimate was too low. After discussion, the question was referred to a specinl committee meeting on the 22nd inst.

Barnard Castle.—Water Power.—The Urban District Council has decided to support the scheme for generating electricity by means of the river Tees.

Bradford.—New Plant.—Preparations are nearing completion at the Valley Road generating station of the Corporation electricity department for the installation, in October, of the new turbo-generator of from 12,000 to 15,000 kW capacity, a similar unit to the generator installed shortly after the armistice. The new installation will increase the capacity of the station to about 40,000 kW. The department is anticipating a steadily-growing demand for power, both for domestic and industrial purposes, and much is hoped from the development of the Thornbury district as an engineering quarter, following upon conditions arising out of the progress of that area during the war.

Canada.—New Hydro-electric Plant.—The largest hydro-electric plant in the Maritime provinces has just been completed at the works of the Bathurst Lumber Company at the Nepisquit Falls, in Restigouche County. Work was begun in May, 1919, and the plant has been completed at a cost of $1,750,000. Provision has been made for three generators, and two have been installed, but at present only one, with a capacity of 4,500 h.p., will be used. The Bathurst Lumber Company will require about 2,500 h.p. for its own plants; another 1,000 h.p. will be used by the Newcastle and Dominion Pulp Mills, leaving a margin of 1,000 h.p. for other demands.—*Reuter's Trade Service* (Bathurst, N.B.).

Continental.—Latvia.—According to the *Financier*, the Latvian Government is in possession of various plans for the installation of hydro-electric stations on the Duna (Dvina) River, which, for the most part, were developed by engineers of the Imperial Russian Government prior to the war. These plans constitute a somewhat complete scheme for utilising the power of the Duna and also for developing the river, through a system of locks and short lateral canals, to make it navigable well into the interior of Russia proper and eventually, through a system of canals connecting with the Dnieper and other Russian rivers, to form an elaborate system of interior water transportation. Five stations are contemplated, and the total cost is estimated at 53,600,000 Russian roubles (1914 gold basis). These are to be at Dahlen (24,000 kW); Keggum (36,000 kW); Ascheraden (16,000 kW); Kokenhusen (80,000 kW); and Stockmannshof (36,000 kW).

Hungary.—Hungary, even with her pre-war boundaries, was not entirely self-supporting as regards coal. Now her situation is far worse, and can only be remedied by an extensive application of water-power. Unfortunately the Peace Treaty also deprived her of much potential water-power, but as it aims at a joint organisation of common water resources between nations, with the help of international capital, large water-power stations may be established. The Lower Danube could, for instance, supply the whole district round Budapest with electric power. The water resources still in Hungarian territory could also be exploited by means of canalisation, but for this scheme international capital is absolutely necessary, as neither Hungary nor any of the Succession States has the capital required.—*Economic Review*.

Germany.—At the twenty-seventh yearly meeting of the Verband Deutscher Elektrotechniker, held at Essen, the presiding engineer, Herr Vogt, gave a brief account of the progress of the German electrotechnical industry during the past year. Referring to the conference on hydraulic power which occupied the last meeting of the Verein, he stated that the water-power works of Bavaria would be able to supply electricity before the end of the present year, and that the Prussian Government would start in the autumn three works on the river Mein. The utilisation of falls on rivers would call for special turbines, and also for special regulators; the Kaplan turbine might become of first importance, although its merits were still under discussion. A certain amount of apprehension had also been entertained regarding the carrying through of very high-pressure lines. At Berlin, a 100,000-V line had been set up linking the Moabit sub-station with that at Berlin-Friedrichsfeld; it was 15 km. long, and the supports, 26 m. high, were situated in populous streets. At the crossings of rivers, canals, and railways, supports 37 m. high were employed.

Dundalk.—Proposed Price Increases.—To counteract the increased cost of fuel oil, increases in the charges of ½d. per unit for power and heating, and 1d. per unit on bioscope supplies to kinema houses were recommended. This had been approved by the Electricity Committee, the increases to take effect on October 1st, but members of the Council objected on the ground that cost of production was coming down, and the matter was referred back to the committee for reconsideration.

Dublin.—Public Lighting.—The full all-night lighting system in Dublin will come into force at the beginning of October. Complaints continue to be made of the present restriction—from 10.15 p.m. to 12.15 a.m.

Protest Against Reorganisation.—Mr. Fred Allan, secretary of the Electricity Committee, has protested against any alteration in his position, duties, or status, stating that, if necessary, steps will be taken to assert his legal rights. The Electricity Committee recommended that Mr. Allan's status be not interfered with pending his release from Ballykinlar Internment Camp, where he is detained, and the Lighting Committee sent

a similar recommendation. The proposal of the Special Committee was to abolish Mr. Allan's secretaryship of both these committees and of the Cleansing Committee. An amendment in favour of delay was moved but was rejected, and the regrouping of various committees approved.

Hereford.—Year's Working.—We have received from the chief electrical engineer (Mr. W. T. Kerr) a copy of the report upon the electricity undertaking for the past financial year. The total income was £21,074, as compared with £16,688 in 1919-20. Working expenses amounted to £17,323, as against £12,653 in the preceding year, leaving a gross profit of £3,751 (£4,035). The net financial result was a loss of £491; this compares with a net profit of £524 realised in the previous year. Referring to this result, the engineer states that he estimates that a loss of £1,200 was caused by the unnecessary restriction of lighting when the department never had less than a three months' stock of coal in hand. The rural supply scheme shows a loss of £1,827, but a note explains that of this sum £1,612 is receivable from the Treasury as a subsidy until the scheme is self-supporting.

Hexham.—Erection of Poles.—A letter from the Electricity Commissioners, read at a recent Urban Council meeting, stated that the necessity for an inquiry into the Council's objection to the erection of wood poles in the district for transmission lines had not been established. This was interpreted as over-ruling the Council's objection. It was resolved to reply that the erection of steel poles would be approved, but if the use of wood poles were persisted in, the Council would move for an injunction restraining their erection.

Isle of Wight.—Proposed Price Increase.—The Rural District Council has decided to oppose a renewed application by the Isle of Wight Electric Lighting Co. for power to raise the charge for electricity supplied to Carisbrooke and Northwood to 1s. per unit, on the ground that the prices of coal and other necessaries for the works have decreased.

Keith.—Proposed Electricity Scheme.—A special committee of the Town Council having reported favourably upon the suggested introduction of an electricity supply scheme to the town, it has been decided to appoint a consulting engineer to draw up proposals.

Liverpool.—Finance.—The electricity inquiry which was held in Liverpool some time ago is recalled in the Birkenhead Corporation's abstract of accounts, which was issued recently. It now appears that the amount of £1,375, which the Council had to pay in counsel's fees, turned what might have been a profit on the local electricity undertaking into a deficit of £788.—*Liverpool Daily Post and Mercury.*

London.—Hampstead.—The total income of the electricity undertaking during the year ended March 31st last was £149,550, and the working expenses £112,996, leaving a gross profit of £36,554. Capital charges amounted to £24,809; the net profit was thus £11,753. After appropriations for renewals, services, a new boiler, &c., a balance of £5,789 remained, which, with £551 from the previous year, was carried forward to the next account.

Maidstone.—Loan.—The Town Council has applied for a loan of £5,135 to meet an excess on the estimated cost of new plant for the electricity works.

Peterborough.—Extension of Supply Area.—The Town Council has applied for a special order to extend the area of supply under the Electric Lighting Order. All the local authorities concerned are offering no objection to the application.

Reigate.—Price Revision.—The Town Council has revised the charges for electricity for heating and cooking and commercial power, as from the September reading of the meters; the charges will be: heating and cooking, 6d. per unit; and power 4d.

Salford.—Sale of Rotary.—The Corporation has accepted the offer of the Stretford Urban District Council to purchase a rotary converter, which is installed at the Broughton Copper Co.'s works, for £1,750, plus alteration and removal costs, estimated to be £365.

South Africa.—Capetown.—For years past it has been a matter of extreme difficulty for any new factories in Capetown and the neighbourhood to get power for motor installations, &c., the power station having been so overloaded that the supply has not nearly equalled the demand. Now, however, with the new machinery that is being installed the supply will be greatly increased, and industry will be able to go ahead once more. Moreover, "in accordance with plan" the local electricity department has for some time past been gradually substituting three-phase a.c. in place of d.c. in various districts, the intention being to provide within a few years the whole of the municipal area with this service, the "City proper" alone remaining on d.c. These changes will, of course, affect to some extent the types of fittings imported.—*British and South African Export Gazette.*

Victoria Falls.—In an article published in a recent issue of the *South African Engineer & Electrical Review* a writer discusses the feasibility of harnessing the Victoria Falls. He states that a detailed survey and the taking of records over a period of eight months was carried out. At the most suitable spot the head available was 360 ft., due to the actual fall, in addition to a 20-ft. drop from the intake to the crest of the Falls. Assuming that the turbines were kept 10 ft. above the water in the cañon and disregarding pipe-line friction, the actual head would be 370 ft. At flood times there is a rise of 44 ft. in the cañon, and at rainy seasons 55 ft. This would reduce the head to 315 ft. Assuming an efficiency of 85 per cent. and a further loss for pipe-line friction the power available is 350,000 kW if the total volume of water could be utilised. The author considers that there is no early prospect of development owing to the high transmission costs involved.

Southport.—Commission for Engineer Discussed.—At a meeting of the Town Council, at which it was resolved to advertise for an electrical engineer at a salary of £800 per annum, the question of paying the engineer commission for securing lower working costs was discussed. A member said that the reduction of costs often depended upon circumstances entirely beyond the engineer's control, *i.e.*, coal price reductions, lower wages, &c. It was decided to leave the question for the consideration of the Electricity Committee.

Todmorden.—Extension of Supply.—In considering further supplies of electricity to outlying districts, the Town Council has agreed to extend to Lydgate, at an estimated cost of £330, and to Robinwood and Cornholme, at an estimated cost of £3,170, subject to agreement being reached with a certain large manufacturing firm as to supply of power to it.

Weymouth.—Year's Working.—The report upon the Weymouth and Melcombe Regis Borough electricity undertaking (engineer, Mr. G. Nicolson, A.M.I.E.E.), for the year ended March 31st last, records a total revenue of £28,359, as compared with £21,981 in the preceding year. Working expenses amounted to £21,673, as against £18,748, leaving a gross profit of £6,686 (£3,233). After the payment of capital charges, &c., a balance of £1,911 was transferred to reserve for renewals, &c.; the previous year's result was a net deficit of £1,551. The number of units sold rose from 1,110,223 to 1,202,591. While the capacity of the plant was 1,131 kW, the maximum demand was only 606 kW.

Walmer.—Gas Company's Powers.—The Ministry of Transport has informed the Urban District Council that it has been decided to defer consideration of the question of revoking the electric lighting powers of the Gas Co. for this year. It was added that at the expiration of this period, if active steps had not been taken to establish an electricity undertaking, the Minister as at present advised would at once proceed to consider the question of revoking the powers under the Act.

Wallasey.—Growth of Undertaking.—The chairman of the Electricity Committee, reporting on the growth of the supply of electricity in the borough, states that there have been 517 new consumers during the year, and an increase of 98,000 units generated. Owing to the non-delivery of a turbine which should have been received in January, but could not be expected to arrive before December next, the Electricity Committee, with its present commitments, cannot take on any more power load and will have to restrict new domestic consumers. During the year arrangements had been made for several transformer stations in the district. Three were now working and four were in hand. About 7,500 yd. of h.p. cable had been laid.

Wakefield.—Extension of Area of Supply.—The Corporation is applying to the Electricity Commissioners for authority to supply electricity for private and public purposes in the parish or township of Lupset in the rural district of Wakefield.

Wimbledon.—Housing Scheme.—The *Morning Post* states, in connection with the Borough Council's housing scheme, that the Ministry of Health refuses to sanction the electric lighting scheme, and also to pass the tenders submitted by the gas company for laying on gas in the estate. It suggested that what it called the high charges of the company might be due to the Corporation's competitive electric scheme, which deprived the company of the advantage of supplying gas for lighting as well as heating. Acceptance of the Council's proposal would make it impossible to refuse the same to other municipalities. The Ministry added that it was responsible for the erection of many thousands of houses, and strict economy was essential.

Winchester.—Year's Working.—The annual report of the city electrical engineer (Mr. R. Ayton) for the year ended March 31st last shows that the revenue of the electricity undertaking was £33,563, as compared with £25,986 in the preceding year. Working expenses totalled £25,147, as against £17,333, leaving a gross profit of £8,416 (£8,653). Although the gross balance was practically the same as that of 1919-20, capital charges reduced the net profit from £2,683 to £1,022. The engineer records that plant which should have been installed by last winter was held up by labour troubles. The existing distribution system is loaded to its fullest capacity, but extensions are in hand to relieve it.

Wrexham.—Bulk Supply.—The Town Clerk has been instructed to continue negotiations with the North Wales Power Co. for a bulk supply of electricity. It was stated at a recent Town Council meeting that the total cost would amount to between £80,000 and £100,000.

York.—Submarine Engines.—Two engines from the German submarine U63 are being installed in the city electricity works.

TRAMWAY AND RAILWAY NOTES.

Aberdeen.—Year's Working.—The report of the general manager of the city tramways (Mr. William Forbes, M.Inst.T.) for the year ended May 31st last shows that the total income from all sources was £191,471, as compared with £169,731 in 1919-20. Working expenses amounted to £157,585, as against £141,852, leaving a gross profit of £33,886 (£27,879). Interest, sinking fund, &c., absorbed £32,305; the net profit was therefore £1,581, a result comparing very favourably with a deficit of £5,203 in the previous year. The total number of passengers carried was 42,953,807, and the total car-miles run 2,307,260.

Belfast.—Strike.—Last week, upon their wages being reduced by 2d. per hour, the men who are engaged on the reconstruction of the tramway track, promptly downed tools. The sum of 1s. 4d. per hour had been agreed upon, and at the meeting of the Corporation on September 1st the matter was discussed, and it was held that these men were engaged on special work, and were entitled to the special wage of 1s. 4d. per hour.

Bradford.—Goods Service.—It is announced that in the next Corporation Parliamentary Bill powers will be sought to transport goods' weights up to ten or twenty tons by the tramways. At present the Tramway Department has powers to carry only moderately-weighted parcels on any route, and on several of the routes only up to 56 lb. One of the chief ideas behind the proposed new powers is to enable the Department to convey coal to factories and bring back factory goods for transfer to the railways for transport to other parts of the country. Cartage in Bradford is difficult because of the city's situation in a hollow of the hills, and cartage charges have always been extremely high. It is held that tramway transport, by saving much handling and time, would enable transport to be very much cheaper. The goods transport could either run in amongst the passenger traffic or be run chiefly at night.

Brighouse.—Projected Extension.—In carrying out road improvements in Crowtrees Lane, Rastrick, the Brighouse Corporation has laid a single track of tramway lines. There is reason to hope that this section is in anticipation of a start being made in the spring with the full scheme of extension of the Huddersfield tramways *via* Rastrick to Brighouse. This extension will link up Huddersfield and Halifax and Huddersfield and Bradford.

Japan.—New electric tramways are projected by the Tobu Tramway Co., Ltd., to cost 6,000,000 yen. The Musashi Electric Tramway Co., a new concern, is to construct and work a line between Tokio and Yokohama, and to supply electricity for other purposes.

Leeds.—Railless Cars.—The Tramway Committee has decided to substitute double-decked railless cars on the Whitehall Road route in the place of the present service of railed cars. Two of these cars are to be run, and one is already completed. The passenger capacity will be 55, as against 30 in the older type of railless car run on several Leeds routes. It is intended to remove the tramway lines on the Whitehall Road route.

Liverpool.—New Type Cars.—The Tramways and Electricity Committee has adopted a new standard type of car built to the designs of the general manager. Its principal features are better means of ingress and egress, simple but efficient ventilation, and improved cleaning facilities. About 20 of these cars are now in use, fourteen of them being old cars reconstructed. The accommodation is arranged as follows:—Upper deck, 28; lower deck, 22; and ten under the canopies. Route indicators are fitted inside the windows of the lower saloon. The Tidswell patent side and lifeguard supersedes the wooden plough shaped frame, which was found costly to maintain.

Llandudno.—Increased Charge for Traction Power.—Owing to a loss of £1,136 upon the power supplied to the Light Railway Co. during the past year, the Council has notified the company that from September 1st the charge will be at the flat rate of 3d. per unit for a period of twelve months.

London.—Collision.—On September 1st two L.C.C. cars collided in the Walworth Road. The only damage that occurred was the shattering of the windows of both cars. Four passengers received minor cuts and bruises.

Manchester.—Dismissal of Cleaners.—The decision to dismiss a number of car cleaners, as an economy measure, has led to unrest among the Corporation's tramway employés. Representations are being made by the men to the City Council and the general manager of the undertaking.

New Zealand.—Tramway Developments.—The Auckland City Council has decided to authorise tramway extensions in the suburbs, involving an expenditure of £82,000. Seven new cars will be required.—*Reuter's Trade Service* (Wellington).

Portrush.—Electric Tramway.—In relation to the possible closing down of the Portrush and Giant's Causeway electric tramway, it is explained that this will be due to the loss of water-power and the compulsory evacuation of the generating station. Hopes are entertained, however, that the latter difficulty may yet be surmounted. The line was opened 38 years ago. The power is generated by the River Bush at Bushmills, where the power-house is situated. Originally a third rail was employed, but subsequently the overhead trolley system was substituted.

Salford.—Threatened Strike.—Owing to the secession of 21 inspectors from the United Vehicle Workers' Union, a strike is threatened at Salford this week-end. The inspectors who remain in the union, and who are in the majority, have resolved to support any action taken by the remainder of the tramway employés to secure the return of those who have left the union. The national executive of the union also signifies its approval.

Wallasey.—Track Repairs.—The Tramway Committee is finding that the tramway rails are wearing away very quickly and is faced with two alternatives: (1) To let the wear continue until replacement is necessary; or (2) to arrest the deterioration by the electric welding of the joints and retreading where the rails are badly worn, and hardening the surface by the oxy-acetylene process. Last year the Council agreed to have three miles done at a cost of £9,500. The work has been completed, and it is now necessary to proceed with the second three miles, which will cost £9,000. About one-third of the length of track will have to be repaired very soon, it is stated.

TELEGRAPH AND TELEPHONE NOTES.

Cyprus.—Money Order Service.—The Postmaster-General announces that a telegraph money order service between the United Kingdom and Cyprus commenced on September 1st. A feature of the new service is that the telegrams of advice may be sent at the deferred rate, which is one-half of the full rate. The full-rate service is available for cases of special urgency.

Malay Archipelago.—Wireless Installation.—Though it is situated in Borneo, the State of Brunei (for administrative purposes) is affiliated with the Straits Settlements, and promises in time to share in the prosperity of the other British possessions in the Archipelago, if one may judge from the report for 1920 by the British Resident, Mr. G. E. Cator. In spite of the depression which marked its closing months, the year was the most successful that Brunei has ever known. During 1920 there was under construction a wireless telegraphic installation which will place Brunei in communication with Singapore and Europe. Purchases of material were made in England on behalf of the Government by Mr. F. H. Dupree, of the Singapore wireless telegraph station, from the Disposals Board and War Office. It is considered probable that the total cost of the installation (including fees and the cost of training operators) will not exceed £800 per station, and there are four stations—at Brunei, Labuan, Brooketon, and Temburong. At present prices that sum would not ordinarily suffice even to purchase the necessary material. By the end of the year, the four stations named above had been erected and equipped, and they were to be ready for use as soon as the balance of the material arrived from England. Mr. Cator acknowledges indebtedness to the Government of British North Borneo and the Island Trading Co. for valuable assistance in connection with the installation.

Mauritius.—Wireless Telegraphy.—The Imperial authorities have decided to discontinue the working of the wireless station erected at Rose Belle, in Mauritius, during the war. As the result of representations by the commercial community, it is possible that this decision may be reconsidered, provided that the local Government will assume financial responsibility for the station. Owing to frequent congestion on the cables passing through Mauritius the wireless station has proved very convenient for the dispatch of messages direct between Mauritius and the Seychelles and Mauritius and Antananarivo, the chief town of Madagascar, says *The Times Trade Supplement*.

Restrictions on Wireless Apparatus Removed.—With reference to the restrictions hitherto in force on the manufacture, purchase, sale, and possession of wireless apparatus, the Postmaster-General announces that, in consequence of the lapse of Regulation 22 of the Defence of the Realm Regulations, such apparatus may now be made (or bought, sold, or held) without permit or restriction. The supervision by the Post Office of dealings in such apparatus has accordingly ceased so far as Great Britain is concerned, but Regulation 23 is still in force as regards Ireland. The Postmaster-General's licence under the Wireless Telegraphy Act, 1904, is still necessary before any apparatus for wireless telegraphy may be installed or worked. An arrangement has, however, been adopted for allowing "toy" sets of wireless apparatus to be used (in Great Britain only for the present) without formal licence, provided that the designs of the sets have been approved by the Postmaster-General, and that the sets have been stamped or marked to that effect before sale. Firms or persons who desire to sell "toy" sets of apparatus for use under this arrangement should furnish full particulars (including illustrations or diagrams) of the apparatus, in order that the design of the sets may be considered. Where the designs appear suitable, it will be necessary to require that specimen sets shall be submitted for inspection before definite approval

is given. Generally speaking, a "toy" set will be regarded as apparatus arranged for transmission and reception as a Hertzian oscillator, and not intended for connection to ear or to any aerial other than small rods with or without vane. The range of such sets should not exceed 50 yards.

Sweden.—Wireless Telephony.—The telegraph authorities are now conducting experiments for linking up the ordinary telephone with the wireless telephone, by means of which a wireless call can at any time be connected with the ordinary telephone system. The experiment has so far been very successful, says the *Daily Telegraph*.

The Telephone Service.—New Exchange.—A new public telephone exchange, named Grosvenor, was opened on September 3rd at 39, South Audley Street, Oxford Street, W. 1, and as it is within the five-mile circle from Oxford Circus, it is within the local fee area of all exchanges within a radius of ten miles from Oxford Circus. The Grosvenor exchange, which has central battery equipment, will start with the transfer of 850 and 110 lines from the Mayfair and Gerrard exchanges respectively, and two weeks later another batch of 200 lines will be transferred from Mayfair.

U.S.A.—The Radio Corporation of America has absorbed the International Radio Co. and thereby acquired patents which are necessary to maintain efficient operation, says the *Financier*.

Wireless Telegraphy.—A Message from Mars?—Mr. J. C. H. Macbeth, the London manager of Marconi's Wireless Telegraph Co., Ltd., described at a recent luncheon assembly, says a New York message to the daily Press, the recent experiments made on the yacht *Elettra* in the Mediterranean Sea which led Mr. Marconi and others to believe that some planet was seeking to communicate with the world. Mr. Macbeth said the apparatus intercepted waves of a length of 150,000 metres, whereas the maximum wave-length produced in the world was 14,000 metres. He said the regularity of the wave-lengths disproved the belief that it was due to electrical disturbances. It is also reported that a number of important experiments in wireless telephony are at present being carried out between Rome and Sicily, a distance of over 500 miles, which are regarded as most satisfactory. At the recent annual meeting of the company held in London, Mr. Marconi is reported to have said: "The results obtained during the last few weeks are of signal importance, and I now believe that, if we have not completely mastered the troubles arising from adverse atmospheric conditions, we have gone far enough to enable me to tell you that this work is of transcendental importance and epoch-making in the conduct of wireless telegraph services throughout the world. The new arrangements not only enable communication to be carried on under conditions which previously made it impossible, but also allow of a very considerable increase in speed and improvement in accuracy." With regard to wireless telephony, considerable progress had also been made, and he had no doubt that this new method of communication might profitably be utilised at once as a practical and reliable system. They foresaw in this direction the possibility of a very large business in all parts of the world both for public and private use. They hoped in the near future, subject to satisfactory arrangements with the Post Office, to create telephonic services with several foreign countries, and also, provided they had the opportunities they hoped to have, a wireless telegraphic service between England and Australia.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Argentina.—October 21st. State Railways. Twelve months' supply of electrical stores.*

Australia.—Melbourne. Victorian Government Railways. October 26th. D.c. arc welding plant (Cont. No. 34,377). Armature banding machine with electric motor and starting gear (Cont. 34,378).*November 2nd. Electric storage battery complete for automatic telephone exchange (Cont. 34,229).*

The closing date for the receipt of tenders for 132 sets of accumulator cells (Cont. 34,171) has been extended to September 28th.*

Adelaide.—October 12th. Postmaster-General's Department. 2,750 yds. telephone cords, 120 hand sets, 160 jacks.*

Bristol.—September 16th. Electricity Department. One 500-kW rotary converter. (August 26th.)

Belgium.—October 3rd. Municipal authorities of Schaerbeek. Terminal boxes complete with circuit breakers and accessories. Service de l'Electricité, 40, Rue de Bethleem, Schaerbeek. Tenders to the College des Echevins, Hotel de Ville, Schaerbeek, Brussels.

Belgian State Railway authorities, at La Salle Madeleine, Brussels, are inviting tenders for the supply at Malines, of 22 lots of miscellaneous electric train lighting material.

Dorchester.—September 10th. Electricity Committee. Replating battery, &c. (August 26th.)

Eastbourne.—September 26th. Electricity Department. One water-tube boiler, fan and chimney, boiler-feed pump and piping; one 2,500-kW turbo-alternator with condensing plant and pipework. (September 2nd.)

France.—October 4th. French Ministry of War. 1,500 kilometres of light cable. Ministère de la Guerre (Service du Genie), 54, bis Boulevard de la Tour-Maubourg, Paris.

Halifax.—September 10th. Electricity Committee. Steelwork in connection with foundations for new turbine set at the electricity generating station.—Mr. A. C. Tipple, acting borough engineer, Crossley Street.

London.—H.M. Office of Works. September 16th. Supply of electrical and mechanical labour-in-daywork in the Cardiff district. (August 26th.)

Bermondsey.—September 23rd. Board of Guardians. Six months' supply of electric lamps. Mr. H. Reeve, clerk to the Guardians, 283, Tooley Street, S.E.

Manchester.—September 13th. Tramways Committee. Motors, controllers and trucks, &c. Mr. J. M. M'Elroy, general manager Corporation Tramways, 55, Piccadilly, Manchester.

New Zealand.—Wellington.—September 27th. Public Works Tender Board. Six sets 3-phase, 50,000-V air-break switches for the Waikato electric power scheme.*

November 29th. Public Works Department, Mangahao electric power scheme: 3 water wheels, three 6,000-kVA and two 3,000-kVA a.c. generators, two 3-unit exciter sets, seven 4,000-kVA single-phase transformers, insulators, lightning arresters, switchboard, &c.*

October 15th. Corporation. Two water-tube boilers with feed-water heaters, superheaters, stokers, &c.; one 5,000-kW turbo-alternator with condensing plant. (September 2nd.)

Salford.—September 13th. Tramways Department. General supplies for three or six months. General Manager, 32, Blackfriars Street, Salford.

South Africa.—Johannesburg. November 7th. Rand Water Board. Two 350-kW steam-driven electrical generating sets, complete with switchboards and all accessories.*

Uruguay.—September 19th. Board of State Electrical Stations. Generating plant for four electrical groups, consisting of a.c. and d.c. generators, Diesel engines, &c.*

Uxbridge.—Board of Guardians. Tenders for converting the electric power plant at the Institution, Hillingdon, from 100 V d.c. to 200 V single-phase, 50 periods, and supplying machinery for same. (See this issue.)

Warrington.—September 27th. Board of Guardians. Electrical goods for three months. Mr. A. Bottomley, Bewsey Chambers.

*** A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W. 1.**

CLOSED.

Australia.—Further to our note on page 55 of July 8th, the Electricity Committee of the Sydney City Council recommended that the offer of Thompsons Pty., Ltd., to supply a 17,500 (nominal) kW turbo-alternator, 3,000 r.p.m., with auxiliary plant and accessories, for £125,000, erected complete, be accepted; the plant is a Westinghouse type manufactured under licence from the Metropolitan-Vickers Electrical Co., Ltd.

The recommendation was considered by the Council on July 12th, but referred to the General Purposes Committee to consider the objections to the acceptance of the contract.

The objections are based on the claim of the English Electric Co. of Australia, Ltd., for priority in this contract, and the protest of the Amalgamated Society of Engineers against the work being placed outside the State. The claim of the English Electric Co. goes back to the arrangement made with Messrs. Willans & Robinson, Ltd., in 1918, when the last-mentioned firm contracted for a 5,000-kW plant, but was unable to proceed with construction owing to War Office requirements. The Council agreed to cancel the contract, and was compensated by the firm to the extent of £618 on condition that the Council placed its next order for main generating plant with Willans and Robinson, Ltd., or Messrs. Dick, Kerr & Co., Ltd. Subsequently Messrs. Willans & Robinson, Ltd., incorporated with the English Electric Co. of Australia, Ltd., and the Council about the middle of 1920 renewed its promise to order the next generating set from the successors of Willans & Robinson, Ltd., namely, the English Electric Co. In the meantime the Council placed a contract with the British Westinghouse Electric & Manufacturing Co., Ltd., for the supply of an 8,000-kW turbo alternator, and the protest of Messrs. Willans & Robinson to this course resulted in the renewed promise mentioned.

A report by the city electrical engineer made in April last on the offers received showed that the English Electric Co. of Australia, Ltd., offered to land a 16,000-kW turbo alternator at £103,150 f.o.b. a British port, or manufacture a similar plant in Australia at cost plus 15 per cent. Messrs. Thompson's (C'maine) Proprietary, Ltd., offered a 12,000-kW alternator at £129,500. The engineer recommended acceptance of the English Electric Co.'s offer of a plant at £103,150, if it was decided to accept a firm offer, though his opinion was that it would be to the Council's advantage to have the alternator constructed locally by the English Electric Co. Another offer for the supply of this plant was received after the date fixed for receipt of these tenders, but was not reported upon.

The General Purposes Committee, on July 19th, decided to confirm the recommendation of the Electricity Committee and give the contract to Messrs. Thompson (Castlemaine) Proprietary, Ltd.—*Tenders.*

Belgium.—No less than twenty concerns, including the Metropolitan-Vickers Co., competed for the recent contract of the municipal authorities of Schaerbeek, Brussels, for the supply of electricity meters; the lowest prices were submitted by M. F. Van Sintjan, of Brussels.

Nine concerns, including one French and one Italian, competed for the recent contract of the municipal authorities of Ixelles, Brussels, for the supply of a quantity of low-pressure armoured cables required in connection with the electric lighting undertaking. The lowest quotation was that of Messrs. Noel, Van Gastel & Mertens, of Brussels.

The Belgian Ministry of National Defence, in Brussels, recently invited tenders for the supply of 5,000 3-electrode valves for use in connection with the military wireless telegraph service. Six concerns competed for the contract, the lowest offer (51,900 fr.) being that of M. J. Vink, of Brussels.

Salford.—Health Committee.

Electric lighting installation at the Nab Top sanatorium, Marple, £1,935.—E. M. Evans & Sons, Ltd.

Tramway Committee.

Gear wheels, £292.—British Hele-Shaw Clutch Co., Ltd.
100 tons of B.S. No. 4 tramway rails, £1,600.—Walter Scott, Ltd.

Electricity Committee.

H.p. switchgear in connection with the supply of electricity to Lloyd's Packing Warehouses, Ltd., Weaste, £846.—Metropolitan-Vickers Electrical Co., Ltd.

Lighting and Cleansing Committee:—
Swan necks for attachment to street lamp pillars (37s. 6d. each), £412.—Brighton Lighting & Electrical Engineering Co., Ltd.

Tasmania.—Tasmanian Hydro-electric Power Supply.

Erection of the transmission lines Waddamana-Risdon and Waddamana-Launceston, £37,900.—G. Cheverton, of Hobart, for the erection of both lines. The contractor will make an immediate start. The contract provides that both lines are to be completed by August, 1922.—*Tenders.*

FORTHCOMING EVENTS.

British Association for the Advancement of Science.—September 7th-14th. At Edinburgh. Eighty-ninth annual meeting.

Shipping, Engineering and Machinery Exhibition.—September 7th to 28th. At Olympia, W.

Birmingham and District Electric Club.—Saturday, September 10th. At the Grand Hotel, Colmore Row. At 7 p.m. Paper, "Canadian Notes," by Mr. N. Deykin.

Salford Technical and Engineering Association.—Saturday, September 10th. At the Royal Technical College. At 7 p.m. Lecture on "Modern Developments in the Manufacture and Use of Coal Gas," by Mr. E. West.

Institution of Mining Engineers.—Wednesday, September 14th. At the Town Hall, Stoke-on-Trent. At 11 a.m. Annual general meeting.

NOTES.

Appointments Vacant.—Switchboard attendant (83s.) for the Redditch Urban District Council electricity works; charge engineer for the Torquay Corporation electricity department; plumber-jointer for the Farnworth Urban District Council electricity department. See our advertisement columns to-day.

Shadowless Light.—A lamp that throws a brilliant shadowless light has been introduced to London, says the *Daily Mail*, by a French firm. It is claimed that if an object is placed between the lamp and the surface to be illuminated, no shadow is cast on the latter. This result is accomplished by means of a cylindrical prismatic lens and a number of silvered mirror reflectors. "There is no heat."

The Theory of Relativity.—Einstein's theory of relativity is to be the subject of a kinematograph film which a German company has engaged some leading scientists to prepare for the autumn. By the use of diagrams and apparatus of various kinds the principles of the new theory will be made intelligible, it is said, to persons who are entirely incapable of understanding mathematical formulæ.—*Evening News.*

Fatilities.—A most unusual fatality occurred last week. Walter Ashton (33), stonemason, was standing on the causeway in Montagu Square, Mexborough, close to an electric light standard when the trolley arm of a passing tramcar slipped the wires, struck the light standard, and knocked off the head, which crashed down and fractured Ashton's skull. He died in the hospital within an hour of the accident.

Caught by the revolving claws of an electrically-driven dough mixer which he had been cleaning, George Gobel, a Deptford baker, was drawn into the machine and terribly injured; he died soon after being admitted to hospital.

"Straphanging" to Remain.—The *Daily Mail* understands that straphanging in tramway-cars and omnibuses, which was due to end on October 1st, is to be allowed to continue until the needs of the travelling public are met with adequate services. This extends the permission given during the war for a certain number of standing passengers in public vehicles. The report of the investigations made by Mr. Frank Elliott, Assistant Commissioner of the Metropolitan Police, is to be issued in a few days, and is expected to delay the operation of the ban for at least six months.

Service Notes.—Major G. A. Bruce, T.D., M.I.E.E., has relinquished his commission in the Territorial Force Reserve of Officers as from the 1st inst. Major Bruce was associated with the Tyne Electrical Engineers for many years, becoming captain in 1903 and major in 1915. Lieutenant C. A. Stephens, Tyne Electrical Engineers, has resigned his commission, to which he was appointed in 1916, getting his second star in 1918. Captain W. H. U. Marshall, M.I.E.E., having attained the age limit, has resigned his commission in the Dorset (Electric Lights) Engineers. Major Marshall joined the regiment in 1910, was promoted captain in 1915 and major in the present year. The following officers of the Tyne Electrical Engineers have been posted to the Reserve of Officers of the Territorial Force in their respective ranks: Capt. J. F. S. Hunter, M.B.E., Capt. L. S. Winkworth, Capt. M. C. James, Capt. D. A. Williamson; Lieuts. H. S. Ripley, M.B.E. (to be captain), Lieuts. R. G. Ellis, A.M.I.E.E., F. S. Corby, and F. W. Bond, all from the 27th ult.

The Trade Union Congress.—"Millions of people lack employment, while the world cries for more and more goods to supply only the bare necessities of life. . . .The workers should press for a shorter working week. . . ."

That is the strange argument of the President, Mr. E. L. Poulton (Boot and Shoe Operatives), in his presidential address to the Trade Union Congress which opened at Cardiff on September 5th. The idea is apparently that with still shorter hours the work of production would be shared by a greater number of men. There were 850 delegates, representing 212 unions, with a total membership of nearly 6¼ millions. The reappearance of Mr. Smillie, the veteran miners' leader, was a feature of the Congress.

News Value or Nuisance Value?—The following editorial under this heading in our excellent contemporary *Chemical and Metallurgical Engineering*, contains a sentiment with which we cordially sympathise:—

On the hottest day yet there came to us a "news note" from a well-known corporation that shall be nameless because it ought to know better. Probably the Old Man does know better but is away on his vacation. The item reads as follows: "Blank Co. Distributes New Blotter. The Blank Co. are placing in the hands of their representatives for distribution a new and attractive blotter. The Blank Co. have always been strong advocates of the blotter for advertising purposes because of its usefulness, its attention value and its ability to drive home its sales message."

This is the kind of information for which our readers are supposed to hunger and thirst; to pay good money for subscriptions so that they may read it and still more good money to have their advertisement accompany it. It pains us to have anybody think so. We have a high opinion of our readers; a sense of brotherhood with them. We talk out of our hearts to them, and feel that they understand, and in return they often talk straight from their hearts to us and we think we understand. We don't set up to be professional highbrows (who are those, according to Brander Matthews, whose instruction exceeds their mental capacity), but at the same time we do not worry over reducing the expression of our opinions to words of one syllable. We do not worry over the adenoids of our readers; we take it for granted that if they ever were congested, they were duly removed; and we do not try to reach the feeble minded or those who are defective.

On the other hand, we want news; all the news that is really news, and that is worth reading and fit to print. Had the company in question developed a new product or process, different from any that is known, and of such value that in our judgement our readers would be glad to know of it, we should have been glad to publish a technical article on the subject. We are not influenced by the advertising value such an article may have to the concern that produces the apparatus or product, if we think it worth while to print it; whereas, if we do not think it worth while, there isn't any money that can get it printed except at advertising rates, and as an advertisement in the advertising section.

We do not print advertisements either as so-called "reading matter"—to fool our readers, or interspersed with it—to disturb them. Advertising is a legitimate art, but it has been made the subject of serious malpractice. One of the most serious phases of this malpractice is to give it nuisance value. It consists in stealing the attention of busy men to tell them something they do not want to know. It has not a tithe of the value ascribed to it. Men with things to do and with obligations to perform are beginning to realise this. If we do not chew tobacco, we do not want to be told which preparation of tobacco to chew. When we read our morning newspaper, and are trying to learn what is being done with the tariff bill in Washington, we do not want to be interrupted by the information that the Maison de Paris is having a grand marked-down sale of lingerie. On the other hand, the woman of the household may want to know about the sale, but may not be interested in the tariff bill. This misplacement of news and advertising is a mistake, so far as we are concerned.

Worse than such a mix-up of understanding and underwear is the publication as news of such inane items as that a corporation has bought some blotting paper and had its name printed on it. That brings the corporation's name before our readers, but it offends them, and rightly so. It does not interest us and we don't see how it can interest anybody else.

Institution Notes.—Institution of Electrical Engineers.—The offer of Mr. E. M. Hughman to give a donation of £250 to the Benevolent Fund, on condition that 19 similar amounts were contributed by June 30th, has been extended by him to December 31st, 1921.

Birmingham and District Electric Club.—The arrangements for the second half of the 1921 session include the reading of papers on "Commercial Efficiency of the Telephone," on October 8th, by Mr. C. G. Findlay; and on "The Gyroscopic Compass," on November 12th, by Mr H. F. Steventon. The annual meeting is to be held on December 10th.

Association of Engineers-in-Charge.—The president for the season 1921-22 will be Capt. H. Riall Sankey, C.B., C.B.E., who will deliver his address on October 12th. Mr. L. Pendred has become a vice-president. The annual dinner will take place on October 8th.

A Watt Memorial.—To mark the recent centenary of James Watt, the Institution of Shipbuilders and Engineers has founded two new chairs in Glasgow University—a James Watt Chair of Electrical Engineering, and a James Watt Chair of the Theory and Practice of Heat. The appointments are likely to be made by the University Court next month.—*The Observer.*

A Swedish Electrical Invention.—Ludvika Elektromekaniska Verkstad has begun the manufacture of a newly invented apparatus by the use of which, it is claimed, all risk in handling high-pressure electric lines is eliminated. The inventors of the apparatus are Mr. Olof Jacobsson (a foreman) and Mr. Gustaf Hendeberg (an engineer). The contrivance, which is simple and easily handled, costs kr. 250.—*Reuter's Trade Service* (Stockholm).

Joint Electricity Authorities.—In accordance with expectations, the financial state of the country has interfered with the movement for co-ordinating electrical undertakings. It was intended to establish a Joint Electricity Authority for the Mid-Lancashire area, and to erect three generating stations, but at a conference on Monday it was decided to postpone the scheme *sine die* in view of the financial obligations which it would involve. Though this does not amount to actual abandonment, the proposal is not likely to be put into operation for a considerable time. Had the scheme gone forward it would certainly have marked a new industrial era in North-East and West Lancashire.

Machinery Required in Sofia.—The Department of Overseas Trade informs us that His Majesty's Legation, Sofia, reports the receipt of an inquiry for quotations required in Philippolis for the equipment of new constructions. The inquirer is also desirous of receiving catalogues for machinery of all descriptions, including dynamos, motors, flour milling plant, pumps (hand and power), stationary and portable electric sets, &c. The Legation has also transmitted an inquiry received from Bourgas for the names of some United Kingdom firms dealing in small machinery and textiles. The names and addresses of the inquirers may be obtained by United Kingdom firms interested on application to the Department.

The Society of Technical Engineers.—We understand that after a long period of preliminary work the Society of Technical Engineers has at last arrived at a general agreement throughout its membership with regard to the broad lines of its policy, and that only the details of the form in which that policy shall be stated remain to be settled. This will shortly be accomplished, and the Society will then be in a position to publish an account of its aims and organisation.

It is noted by the Labour correspondent of *The Times* that the movement towards the organisation of the brain-workers has become international, proposals having been put forward in that connection in Switzerland and Italy, whilst in Austria an Act has already come into force affecting them in certain professions.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the comercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Mr. W. J. Hancock, M.Inst.C.E., M.I.E.E., Government electrical engineer, Western Australia, has retired after 37 years' service. Mr. Hancock was responsible for the construction and establishment of the first Perth and Fremantle telephone exchange systems, repairing and relaying of the Breaksea submarine cables, &c.

Mr. J. Oxenham, permanent head of the Commonwealth Postmaster-General's department, has returned to Australia from a business visit to England, America, and the Continent. —*Commonwealth Engineer.*

The marriage took place at the Parish Church, Crediton (Devon), on September 1st, of Mr. R. J. Webb, A.M.I.E.E., engineer of the Ebro Irrigation & Power Co., of Barcelona, and Miss Alison Francis, eldest daughter of Mr. S. B. Francis, of Crediton.

Mr. W. M. Milnes, chief assistant engineer, of the Coventry Corporation Tramways, who is leaving to become general manager of the Corporation Tramways at Wigan, has been presented by the staff with a silver fruit dish, rose bowl, and attaché case.

Mr. Chas. Mallins, M.I.A.E., A.I.E.E., late general manager of the Liverpool Corporation motor-'bus and tramway service, is joining the board of the Samuelson Transport Co., Ltd.

Among the arbiter's awards following claims made by Leith officials arising out of the amalgamation of the burgh with Edinburgh appears the following: Mr. A. P. Rutherford, late electrical engineer, Leith, amount of claim, £6,500; Corporation's offer, £1,500; award, £4,000.

Major-General Geo. O. Squier, chief signal officer of the U.S. Army, left London last Saturday, the 3rd inst.

Mr. William Walker, director of health and safety in the Mines Department and formerly chief inspector of mines, retired on August 31st.

Mr. H. Nimmo, M.I.E.E., of the Public Works Department, Burma, who is at home on leave (address: The Sports Club, St. James's Square, S.W.1), will be glad to give our readers any information at his disposal regarding the cost of living, trade prospects, &c., in Burma.

Alderman Barrett has been appointed chairman of the Salford Corporation Tramways Committee, and Councillor H. S. Hind has been elected deputy-chairman.

Mr. F. Ayton, M.I.E.E., at present chief engineer and manager of the Corporation Electric Supply and Tramways at Ipswich, is taking up his new position with Messrs. Ransomes, Sims & Jefferies, Ltd., on the 14th instant, after which all communications should be addressed to him at Orwell Works, Ipswich. On and after the date mentioned communications relating to the business of the Corporation Electricity Supply and Tramway Departments should be addressed to the new chief engineer and manager, Mr. A. S. Black, M.I.E.E.

On August 23rd, at All Saints' Church, Habergham, Mr. T. W. Horton, shift engineer at the Corporation Electricity Works, Leigh, Lancs., was married to Miss Edith Walley, only daughter of Mr. and Mrs. F. Walley, Ightenhill, Burnley.

Mr. H. Wilson is vacating his position as mains superintendent to the Maidstone Corporation early in October on appointment as distribution engineer at the Croydon Electricity Works.

Mr. E. E. Hoadley, M.I.E.E., engineer and manager of the Corporation Electricity Supply Undertaking at Maidstone, has been appointed honorary secretary of the Electric Vehicle Committee, in succession to Mr. F. Ayton, M.I.E.E., who has held the position since the committee's inception, and who resigned upon his appointment as joint managing director of Messrs. Ransomes, Sims & Jefferies, Ltd. Upon severing his connection with municipal work, Mr. Ayton ceases to be a representative of the I.M.E.A. on the Committee, and accordingly, at the last meeting of the Committee, he was elected a member in his personal capacity and re-elected chairman for the year ending March 31st next. All communications in connection with the Electric Vehicle Committee and its work should in future be addressed to Mr. E. E. Hoadley, Electricity Works, Maidstone, Kent.

Obituary.—Sir F. Brain.—We regret to learn from the *Evening News* of the death of Sir Francis Brain, a distinguished mining engineer and a pioneer in the use of electricity in mining operations, who was a member of the Advisory Committee under the Government control of coal mines. Knighted in 1913, Sir Francis belonged to an old Forest of Dean family, and was an alderman of the Gloucester County Council.

Victor E. Joyce.—We regret to learn of the death of Mr. Victor E. Joyce, who was works manager and a director of Park Royal Engineering Works, Ltd. On his return from holidays he was taken ill through blood poisoning, which developed rapidly, and death ensued in the course of a week. The interment took place at Ealing on the 3rd instant, when a large number of the employés from Park Royal, together with the staff and such of the directors as were in town, attended to show their sympathy and esteem.

NEW COMPANIES REGISTERED.

Tisbury Electric Supply Co., Ltd. (176,539).—Registered August 30th. Capital, £6,000 in £1 shares. To generate and supply electric current for light, power, and other purposes in Tisbury, Wilts. Minimum cash subscription 90 per cent. of the shares offered. The first directors are: A. J. Fippard, Broad Sanctuary Chambers, Westminster, S.W.1; W. W. Kendall, High Street, Tisbury; A. B. Randall, 27, Victoria Road, Salisbury; E. D. Webb, Gaston Manor, Tisbury. Qualification, £25. Remuneration as fixed by the company. Secretary: A. B. Randall. Registered office: Town Mill, Salisbury, Wilts.

Electrolux, Ltd. (176,547).—Private company. Registered August 31st. Capital, £5,000 in £1 shares. To carry on the business of electricians, electrical and mechanical engineers, &c., and to acquire from the A. B. Electrolux, Stockholm, the trade-mark "Electrolux," and the goodwill of the business carried on by them in England in connection therewith. The subscribers (each with one share) are: A. Urry, 17, Acton Street, W.C.1, clerk; J. G. Hawes, 10, Endsleigh Terrace, Dukes Road, W.C.1, clerk. The first directors are: A. L. Wenner-Gren (chairman) and J. Scrivener. Registered office: 73, Newman Street, W.1.

Scottish Engineering Corporation, Ltd. (11,852).—Private company. Registered in Edinburgh August 31st. Capital, £10,000 in £1 shares. To acquire the business of the Scottish Engineering Corporation, carried on at 128, Hope Street, Glasgow. The first directors are: J. A. Beveridge, 31, Clifford Street, Ibrox, Glasgow, clerk; A. H. Hughes, 46, Woodlands Road, Glasgow, merchant. Qualification, 100 shares. Secretary: J. A. Beveridge. Registered office: 128, Hope Street, Glasgow.

British Association for the Advancement of Radiology and Physiotherapy. (The word " Limited " being omitted from title by licence of the Board of Trade.) (176,568).—Registered September 1st as a company limited by guarantee. The objects are: To promote the advancement of radiology and physiotherapy on scientific lines under the direct control of the medical profession. The management is vested in a Council, the first members of which are: R. Knox, 38, Harley Street, W., consulting radiologist; F. Hornaman-Johnson, 66, Harley Street, W., consulting radiologist; O. MacGregor, 14, Welbeck Street, consulting electrotherapist; S. G. Scott, 6, Bentinck Street, W., consulting radiologist; Sir Archibald D. Reid, 30, Welbeck Street, W., consulting radiologist; S. Melville, 9, Chandos Street, W., consulting radiologist; Agnes Savill, 7, Devonshire Place, W., electrotherapeutist and dermatologist. Solicitors: Bristows, Cooke and Carpmael, 1, Copthall Buildings, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Dartmoor Electric Supply Co., Ltd.—Particulars of £2,500 debentures authorised November 27th, 1919, whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital. Particulars filed August 16th, 1921.

Bell's United Asbestos Co., Ltd.—Issue on August 25th, 1921, of £1,700 debentures, part of a series already registered.

Babcock & Wilcox, Ltd. (65,805).—Return dated June 1st, 1921. Capital, £2,460,000 in £1 shares (100,000 6 per cent. preference, 200,000 5 per cent. second preference, and 2,160,000 ordinary). 100,000 6 per cent. preference, 179,056 5 per cent. second preference, and 2,148,828 ordinary shares taken up. £1,027,875 paid. £1,400,000 considered as paid. £9 remains in arrears. Mortgages and charges, nil.

Hooper's Telegraph & India-Rubber Works, Ltd. (40,947).—Return dated July 12th, 1921. Capital, £50,000 in £10 shares (1,000 preference and 4,000 ordinary). All shares taken up. £40,000 paid and £10,000 considered as paid. Mortgages and charges, nil.

CITY NOTES.

French Companies. *Société d'Electro-Chimie et d'Electro-Métallurgie.*—According to the report presented to the ordinary general meeting on May 25th, the net profit on the working of 1920 amounted to 3,709,495 fr., from which a dividend of 45 fr. per share was sanctioned.

Compagnie Electrique du Nord.—The accounts for 1920 presented at the ordinary meeting on July 29th showed net profits, after setting aside 300,000 fr. to the sinking fund, of 375,000 fr., which were again carried forward. The capital has now been increased from 12,500,000 fr. to 14,500,000 fr.

Eclairage et Force par l'Electricité à Paris.—The accounts for 1920, presented at the meeting on June 27th, showed net profits of 436,429 fr., against 370,200 fr. in the previous year. The available balance, after addition of the carry-over of 1,682,656 fr. from the last report, amounted to 2,121,085 fr., against 2,182,655 fr. The amount of the distribution was not stated. A dividend of 25 fr. per share was declared last year.

New Issues.—The issue of £350,000 debentures of the *Thames Valley Electric Power Board* (*N.Z.*) having been over subscribed, the list was closed at 11 o'clock on Wednesday morning last week; owing to the heavy over subscriptions it was found impossible to consider applications received through the post.

Stock Exchange Notices.—Dealings in the following securities have been specially allowed by the Stock Exchange Committee under Rule 148a:—

Thames Valley Electric Power Board.—£350,000 six per cent. debentures of £100 each, issued at 96 per cent. 46 per cent. paid (guaranteed by New Zealand Government), after issue of allotment letters.

The undermentioned have been ordered to be officially quoted:—

Barcelona Traction, Light & Power Co.—£1,050,000 8 per cent. secured debentures, Nos. A1 to A7,000 (£100), and B1 to B700 (£500) bearer.

Shanghai Electric Construction Co.—3,490 shares of £10 each, fully paid, Nos. 36,511 to 40,000.

Direct Spanish Telegraph Co., Ltd.—Dividend at the rate of 10 per cent. per annum on the preference shares and an interim dividend at the rate of 8 per cent. per annum, free of income tax, on the ordinary shares for the half-year ended June 30th.

Canadian General Electric Co., Ltd.—Dividend of 2 per cent. for the three months to September 30th on the common stock and 3½ per cent. for the half-year on the preference stock.

Fraser & Chalmers, Ltd.—The liquidator is now making a further payment of 9d. per share, which will bring the total return of capital up to 32s. 3d. per £1 share.

Brazilian Traction, Light & Power Co.—Quarterly dividend of 1½ per cent. on preference shares.

Davis & Timmins.—Interim dividend of 3 per cent., free of tax, on the ordinary shares for the half-year.

American Telephone & Telegraph Co.—Dividend of 2¼ per cent., less tax.

STOCKS AND SHARES.

Tuesday Evening.

The holiday season being regarded as practically over, the Stock Exchange markets are displaying a reasonable amount of activity, and the trend of values has been generally upward. In spite of the calls which are made upon capital, investment continues to absorb readily enough whatever good stock comes to market. The Thames Valley (New Zealand) Power Company's 6 per cent. debentures, guaranteed by the New Zealand Government, were promptly over-subscribed. The subscription-lists were open for a couple of hours only. The market in the scrip began to-day, Tuesday, and the price is quoted 1 premium. The Southland Power Company's debenture stock, offered at the same price and on similar terms, commands a premium of 1½.

Nor are the home country's issues neglected. North Metropolitan 7½ per cent. Extension debenture and Metropolitan Electric 7½ per cent. debenture have both risen to 8 premium over and above their issue price of 95. General Electric 7 per cent. debenture has risen to 98, a premium of 5 points. The Shropshire Electric Power 7½ per cent. debentures remain about ½ premium. Several of the issues recently made by iron and steel companies, the prices of which have been standing at a discount, are recovering to their par levels.

It is worth noticing, in the strong investment demand, that Home Railway debenture stocks are again coming into favour. Metropolitan 3½ per cent. debenture stock has risen to 57½. District debentures are difficult to obtain. The 6 per cent. permanent debenture stock is quoted at 89, which compares, incidentally, with 137½ at which the stock stood on the outbreak of war. District 4½ per cent. first preference changed hands this week at 60. London Electric 4 per cent. preference has been done at 52, at which the yield on the money is 7¾ per cent. East London debentures continue to be put up. The company's 4 per cent. " A " debenture stock stands at 60. The " B " debenture, which received ½ per cent. for last year, changed hands the other day at 37¾, while a little speculation is springing up in the 4 per cent. third debenture stock, a fair number of bargains having been done about 15¼. The company's ordinary stock has strengthened to 4.

Metropolitan ordinary at 25½ is ½ lower, but Districts remain at 17½. Underground Electric Income Bonds are quoted 76½ ex the coupon of £2 net due on September 1st. The market valuation of the coupon is £2 11s. per cent. net, owing to the premium it commands by reason of the interest being payable in New York as well as in London.

Electricity supply shares are a better market. County of London have risen 5s. to 8½. St. James's at 6¼ are similarly better. Metropolitans are half-a-crown higher at 3¾. Westminster ordinary, although quoted at 5¼ middle, are more like 5¾. Dealers in the market are not anxious to put up prices, but their hands are being forced against themselves, and the pressure to buy is consistent. With the early termination of Summer-time, this is, of course, the season of the year to which the investor begins to pay a little attention to what are called illumination securities, and with the improvement in electrical shares, there has come a pretty general advance in gas stocks.

The manufacturing list is inclined to be slightly harder, but there is still a good deal of nervousness in regard to the possibility of German competition. Edisons have dropped to 6s. 3d., recent transactions being marked at 7s. India-Rubber shares have been done at 15s. On the other hand, there is a noticeable demand for the pre-ordinary issues. British Insulated 4½ per cent. debenture at 95½ is 2 up, and the company's 5 per cent. debenture stock at 93½ shows a gain of 5 points. British Aluminium debentures, although unchanged in price, are also wanted. The 5 per cent. prior lien debentures stand nominally about 73 and the 5½ per cent. debenture stock at 71. Stock changed hands in the last-named the other day at this price. General Electric debenture, as already noted, has jumped to 98. The company's ordinary shares remain at £1, and both classes of preference stand about 17s. 6d. Callender's preference have risen to 18s. 9d. Telegraph Constructions at 21½ are the fraction to the good. In the foreign list, Calcutta Electric new preference shares, 5s. paid, have hardened to 5s. 9d. The recent nervousness perceptible in stocks and shares connected with India is passing away, and most of the recent falls have been recovered.

Further progress has been made in the exchange process that is going on between Mexican Light & Power Fives and Mexico Tramway Fives. The price of Mexican Light First Bonds has dropped to 49½, while Mexico Tramway 5 per cents. at 58 have recovered the full amount of the coupon taken off last week. Brazil Tractions are better at 29, but in the British Columbia group, the deferred stock at 55 is 3 points lower. Anglo-Argentine Tramways show no changes. Midland Electric 5 per cent. debenture stock at 78½ is about a point down.

Anglo-American Telegraph preferred at 86 has again improved, and Great Northern Telegraphs, after being 25½, went back to 25, at which they still show a rise of 12s. 6d. on the week. The Eastern group is a little easier, with Eastern Telegraph ordinary down a point to 162½. (Parenthetically, reference may be forgiven to the fact that the wonderful summer weather makes it seem almost paradoxical for the Eastern company to be playing Rugby football matches these hot afternoons at its Hampstead training school.) Marconis at 1 13/16 are 1/16 down, owing to the complete absence of public interest in the shares, and Marconi Marines, after giving way to a guinea, recovered to 21s. 9d. Business in this market has dwindled to meagre proportions.

Babcock & Wilcox at 2½ show a rise of 1s. 3d., but the advance that had been taking place in iron, coal and steel shares received something of a check from the speech of the President of the Trade Union Congress, in which he foreshadowed a demand for shorter hours of work. This affected armament shares as well. Vickers, after being over 14s., went back to 13s., and Armstrongs from 19s. 3d. drooped to 18s. 6d. The strength of the iron and steel market attracted a little local selling from Cardiff and Sheffield. Interest in the rubber market is confined to the efforts that are being made to establish, upon a sound foundation, the new Rubber Shareholders' Association. We understand that up to the present the Association has secured support from about 500 proprietors of rubber shares, but as it is computed that there are at least 50,000 people who own shares in rubber-producing companies, it is obvious that the Association has a wide field left from which to draw that measure of support which alone can render its inauguration a success in the way of making itself felt in regard to control of the industry.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1919.	Dividend 1920.	Price Sept. 6, 1921.	Rise or fall.	Yield. £ s. d.
Home Electricity Companies.					
Brompton Ordinary	12	12	12½	+ ½	£10 0 0
Charing Cross Ordinary	7	8	4½	—	9 8 4
do. do. do. 4½ Pref.	4½	4½	5¼	—	7 4 4
Chelsea	4	6	5¾	—	9 4 8
City of London	13	14	14	—	10 3 0
do. do. 6 per cent. Pref.	6	6	17/-		7 1 0
County of London	8	8	8¼	+ ½	9 0 6
do. do. 6 per cent. Pref.	6	6	8½	—	7 7 4
Kensington Ordinary	7	9	4½	—	10 18 4
London Electric	2½	2½	1	—	7 10 0
do. do. 6 per cent. Pref.	6	6	2¼	—	10 9 0
Metropolitan	6	7	8¼	+ ½	9 0 6
do. 4½ per cent. Pref.	4½	4½	5¼	—	7 16 0
St. James' and Pall Mall	12	12	6¼	+ ½	9 4 8
South London	6	7	9½	—	10 13 2
South Metropolitan Pref.	7	7	15/9	—	8 17 10
Westminster Ordinary	10	10	6½	—	8 13 10
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	86	+ ½	6 19 6
do. Def.	1½	1½	17½	—	8 14 2
Chile Telephone	5	5	5½	—	5 14 3
Cuba Sub. Ord.	7	7	7½	—	9 6 8
Eastern Extension	10	10	18½	—	5 2 0
Eastern Tel. Ord.	10	10	162½	— 1	6 3 0
Globe Tel. and T. Ord.	10	10	165	—	6 0 4
do. do. Pref.	6	6	94	—	6 6 4
Great Northern Tel.	23	24	25	+ ½	9 12 0
Indo-European	10	10	30	—	6 6 8
Marconi	26	15	1 13/16	— 1/16	8 5 6
Oriental Telephone Ord.	12	12	2 1/16	—	*5 16 8
United R. Plate Tel.	8	8	6¾	—	*6 10 4
West India and Panama	Nil	Nil	6/8		Nil.
Western Telegraph	10	10	165	—	*6 1 2
Home Rails.					
Central London Ord. Assented	4	4	47½	—	8 8 6
Metropolitan	1½	1½	28½	— ½	5 17 8
do. District	Nil	Nil	17⅝	—	Nil
Underground Electric Ordinary	Nil	Nil	2½	—	Nil
do. do. "A"	Nil	Nil	6/6	—	Nil
do. do. Income	4	2	76½xd	— ½	*3 18 5
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref.	5½	19½	92	—	10 0 0
do. do. 2nd Pref.	Nil	5½	21	—	10 0 0
do. do. 5 % Deb.	5	5	64	—	7 16 0
Brazil Tractions	Nil	Nil	29	+1	Nil
British Columbia Elec. Ry. Pfce.	5	5	60	—	8 6 8
do. do. Preferred	5	93/-	55½	—	*8 11 2
do. do. Deferred	8	124/-	86	—2	*11 3 2
do. do. Deb.	4½	4½	60½	—	7 2 10
Mexico Trams 5 per cent. Bonds	Nil	Nil	58xd	+ 3½	—
do. 6 per cent. Bonds	Nil	Nil	25	—	Nil
Mexican Light Common	Nil	Nil	9	—	Nil
do. Pref.	Nil	Nil	17½	—	Nil
do. 1st Bonds	Nil	5	49½	—2	10 2 0
Manufacturing Companies.					
Babcock & Wilcox	15	16	2½	+ 1/16	6 8 0
British Aluminium Ord.	10	10	17/6	—	11 8 6
British Insulated Ord.	15	15	1 5/16	—	9 12 0
Callenders	15	15	1 7/16	—	10 8 8
6½ Pref.	6½	6½	18/9	+ 1/16	6 18 8
Crompton Ord.	10	10	14/6	—	13 15 10
Edison-Swan	10	—	6/3	—2/-	—
do. do. 5 per cent. Deb.	5	5	68	—	7 7 1
Electric Construction	10	10	16/9	—	11 18 10
English Electric	8	8	11/-	—	14 11 0
Do. Pref.	6	6	14/-	—	8 11 6
Gen. Elec. Pref.	6½	6½	17/6	—	7 13 0
do. Ord.	10	10	20/-	—	10 0 0
Henley	15	15	1 7/16	—	10 5 0
do. 4½ Pref.	4½	4½	8½	—	5 18 6
India-Rubber	10	—	3/3	—	—
Met.-Vickers Pref.	8	8	11½	—	9 9 4
Siemens Ord.	10	10	1 7/16	—	*8 18 2
Telegraph Con.	20	20	31½	+ ½	*5 13 1

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, September 7th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	8½d.	..
a Ammoniac Sal	per ton	£65	..
a Ammonia, Muriate (large crystal)	"	£58	..
a Bisulphide of Carbon	"	..	..
a Borax	"	£31	£3 dec.
a Copper Sulphate	"	£31	..
a Potash, Chlorate	per lb.	6d.	..
a " Perchlorate	"	6d.	2d. dec.
a Shellac	per cwt.	£14 10s.	..
a Sulphur, Sublimed Flowers	"	£16	..
a " Lump	"	£15	..
a Soda, Chlorate	per lb.	3½d.	..
a " Crystals	per ton	£7	..
a Sodium Bichromate, cask's	per lb.	6½d.	½d. dec.
METALS, &c.			
g Babbitt's Metal Ingots	per ton	£90 to £175	..
c Brass (rolled metal 2" to 12" basis)	per lb.	10¾d.	..
c " Tubes (solid drawn)	"	1/0½ to 1/0½	½d. dec.
c " Wire, basis	"	11½d.	..
c Copper Tubes (solid drawn)	"	1/2½	½d. dec.
c " Bars (best selected)	per ton	£103	£3 inc.
c " Sheet	"	£103	£3 inc.
c " Rod	"	£103	£3 inc.
d " (Electrolytic) Bars	"	£73 10s.	10s. inc.
d " Sheets	"	£145 10s.	10s. inc.
d " Wire Rods	"	£89 10s.	10s. inc.
d " H.C. Wire	per lb.	11¾d.	⅛d. inc.
f Ebonite Rod	"	3/6	..
f " Sheet	"	3/-	..
g German Silver Wire	"	2/9	..
h Gutta-percha, fine	"	13/7	..
h India-rubber, Para fine	"	1/1	..
i Iron Pig (Cleveland Warrants)	per ton	Nom.	..
i " Wire, galv. No. 8, P.O. qual.	"	£30	£5 dec.
g Lead, English Pig	"	£24 5s.	..
g Mercury	per bot.	£10 5s.	2/6 to 5/- dec.
e Mica (in original cases) small	per lb.	3d. to 3/-	..
e " " " medium	"	4/- to 8/-	..
e " " " large	"	10/- to 20/- & up	..
p Phosphor Bronze, plain castings	"	1/4 to 1/9	..
p " " rolled bars and rods	"	2/1 to 2/6	..
p " " rolled strip & sheet	"	2/2 to 2/7	..
d Silicium Bronze Wire	per lb.	1/3½	..
r Steel, Magnet, in bars	"	1/6	..
n Tin, Block (English)	per ton	£161	£11 to £12 inc.
n " Wire, Nos. 1 to 16	per lb.	3/6	3d. dec.
p White Anti-friction Metals	per ton	£65 to £275	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
p ———
r W. F. Dennis & Co.

New System of Sanding Rails.—Mr. James Southworth, of Wigan, an engine driver on the Lancashire & Yorkshire Railway, has invented and patented a new system of sanding rails to prevent locomotives and other railway and tramway vehicles slipping. An engine has been fitted with the invention at the Wigan sheds of the Lancashire & Yorkshire Railway, where demonstrations of the utility of the system have been successfully carried out. The apparatus can be used on railways and tramways generally, and its utility as a money and labour-saving invention is said to be manifest in collieries, engineering works, and other industrial establishments where heavy loads are continually being moved in the sidings and on the works railways. The device, by the use of which all the paraphernalia at present required for the sifting, drying and pulverising of sand, may at once be done away with, can be easily fitted to all existing types of engines.—*Manchester Guardian.*

Electricity in the Antarctic.—Sir Ernest Shackleton's Antarctic Expedition is to utilise wireless telephone apparatus which will insure all its sections being kept in constant touch with one another while engaged in work of exploration. Marconi's Wireless Telegraph Co. is fitting two 100-watt YB wireless telegraph and telephone sets on board the *Quest*. One of these is for permanent use on board the ship, and the other for base work on land; their range is about 100 miles. The Avro aeroplane which is being taken with the expedition will also be fitted with a Marconi wireless telephone so that it will be able to maintain telephonic communication with the *Quest* and also with the land base. Electricity is to be made use of for many purposes, including the heating of clothing for the crew.

School of Instruction in Radiography, &c.—A school for the training of technical assistants in X-ray and electrical departments has been instituted at the King's College Hospital, Denmark Hill, S.E. The school is under the supervision of Dr. R. Knox, director of the radiographic department. For full particulars see our advertisement pages to-day.

THE BRITISH ASSOCIATION.—I.

The eighty-ninth annual meeting of the British Association for the Advancement of Science, and the fifth which has been held in Edinburgh, opened on Wednesday last with the delivery of the presidential address by Sir T. Edward Thorpe, which we review below.

Edinburgh, as perhaps is only natural, claims a long and intimate acquaintance with the Association, which first met in the city in 1834, when the Association was only two or three years old; the attendance of about 1,300 members then was considered very satisfactory. The next Edinburgh meeting was in 1850; the third, in 1871, was under the distinguished presidency of Lord Kelvin, then Sir William Thomson. The last meeting was held in 1892, when the eminent geologist, Sir Archibald Geikie, was president; electrical subjects loomed large on this occasion. Prof. Unwin, addressing the Engineering Section, mentioned a hydro-electric installation of 1,600 h.p. at Genoa, and the "huge scheme now nearly complete at Niagara, an available power of 7,000,000 horse." Messrs. Purdon and Walters contributed copious notes on the utilisation of water power by means of turbines, and mentioned that it might be possible to use the enormous power of tidal rivers—but did not touch upon the Severn. Mr. Alexander Siemens spoke of the working results of two "Siemens" electric locomotives, developing a maximum of 110 b.h.p., supplied to the City & South London Railway. Mr. (Dr.) Gisbert Kapp read a paper on the transmission of power by alternating current. A report by a committee of the most distinguished electrical men of the time, upon the construction and issuing of practical standards for use in electrical measurements, bore witness to a great deal of work by Mr. (Sir Richard) Glazebrook. The German view of British standards was presented by Prof. von Helmholtz, who was accorded a wonderful reception. Prof. S. P. Thomson, and many others, also read papers upon a variety of electrical subjects.

Sir T. Edward Thorpe, this year's President, is well known as one of the most prominent of British chemists. He is Emeritus Professor of General Chemistry in the Imperial College of Science and Technology, and has held numerous other educational and scientific positions. Among these may be mentioned the offices of Treasurer and President of the Chemical Society; President of the Society of Chemical Industry; Vice-President of the Royal Society; and Director of Government Laboratories, London. His connection with the British Association is a long one; he was President of the Chemical Section in 1890, and Vice-President in 1900. He has written a number of works on chemistry, including two on qualitative and quantitative analysis and a "Dictionary of Applied Chemistry."

Prof. A. H. Gibson is presiding over the Engineering Section (G), and his address will be abstracted in a later issue.

We have recorded in recent issues one or two innovations which have been introduced into the proceedings this year. One of the most important of these is the decision to permit discussions upon the addresses of the presidents of Sections. This will no doubt allow of the elucidation of obscure points, which are always liable to inclusion, and also afford the speakers an opportunity to amplify other statements.

The first half of the President's address reviewed the activities of the Association from its inception in 1831, appropriately emphasising the fact that it was largely Scottish in origin, and mentioning in this connection the work of Sir David Brewster, described as the virtual founder, and Principal Forbes. Lord Kelvin's year (1871) was described in glowing terms, reference being made to his advocacy of the institution of national research laboratories. Sir Edward here mentioned that it was in 1871 that his connection with the Association commenced. Touching upon the principal scientific events of the intervening 50 years, he recalled the discovery of argon by Lord Rayleigh; of radium by Madame Curie; of helium as a terrestrial element by Ramsay; and the production of helium from radium by Ramsay and Soddy. In pure physics the half-century had witnessed Hertz's discovery of electromagnetic waves and the rise of Lorentz's electron theory. The telephone, incandescent lighting, wireless telegraphy, the application of the Röntgen rays, the electric transmission of energy, and the kinematograph had all appeared since the Edinburgh meeting of 1871. The need for research was again emphasised, and satisfaction was expressed at the great step accomplished by the establishment of the Department of Scientific and Industrial Research. Sir Edward then dealt at some length with the molecular theory of matter, and spoke of the work of the most prominent men in this field of research. The discovery of the electron was commented upon, tribute being paid to such scientists as Soddy, Rutherford, J. J. Thomson, Collie, and Mosely. The speaker referred to the experiments of Mr. F. W. Aston, who had succeeded in showing that a number of elements were in reality mixtures of isotopes; he gave several examples of this fact, including argon, chlorine, bromine, &c. It was now known that the number of electrons in an atom of an element was equal to the atomic number of that element corresponding, that is, to the position which it occupied in the series when the elements were arranged in the order of their atomic weights. The investigations of Sir J. J. Thomson into the electronic theory of matter were described in some detail by the speaker, who showed that the periodic law evolved agreed with that of Mendéléeff or the Law of Octaves of Newlands. Referring to the horrors of scientific warfare such as had been witnessed in the last few years, Sir Edward concluded his address by hoping that the Association would set its face against the continued degradation of science in this augmenting the frightfulness of war, and use its influence in arresting a course which was the very negation of civilisation.

This year's *Journal* is quite a bulky publication, and there are those who think that too much is being attempted in the short space of a week. This will probably lead to those interested in a particular section confining their attention solely to that section, lest mental indigestion supervene.

Section G—Engineering—commenced its duties early on Thursday morning, devoting the first part of the day to the study of stresses and strains in timber, ship's plates, steel ropes, &c. Prof. T. Hudson Beare read a paper on "The Influence of the Width of the Specimen upon the Results of Tensile Tests of Mild Steel and Rolled Copper," and Prof. Henry Briggs described two new forms of rescue apparatus for use in mines. The address of the president of the section was given this morning (Friday).

In Section A—Mathematical and Physical Science—Mr. A. A. Campbell Swinton described the reception of wireless waves on a shielded frame aerial. Mr. J. J. Dowling demonstrated, on Thursday afternoon, the recording ultra-micrometer in which variations of the capacity in an oscillating valve circuit cause variations of the plate circuit current. A potential balancing device enables a sensitive galvanometer to be employed to record these changes and extremely minute changes in capacity due to the relative displacement of plates (10^{-9} cm. or less) are readily detectable. The apparatus is used for seismographical work and as a micro-pressure manometer, among other things. Dr. Dawson Turner and Mr. D. M. R. Crombie demonstrated the behaviour of an electrified pith ball in an ionised atmosphere. The experiments showed the effectiveness of various sources of ionisation, such as an arc light, burning magnesium wire, incandescent platinum wire, Nernst filament, a Bunsen flame, X-rays and radium rays. The directive influence of a charged Leyden jar was demonstrated by the concentration of the ions along a line joining the centre rod of the jar and the source of ionisation; unless the pith ball was in this line,

it appeared to be unaffected. The effect upon the ball appeared to be independent of the nature of its charge. Prof. O. W. Richardson, the president of Section A, delivered his address on "Problems of Physics" this morning, and an abstract of it is given below.

Wages and the cost of living were the main subjects of Section F—Economic Science and Statistics; Mr. W. L. Hichens, president, spoke on "The Principles by which Wages are Determined," this morning.

Some of the (to our readers) more important papers and addresses are given in abstract form below.

Problems of Physics.

Presidential Address by Prof. O. W. Richardson, D.Sc., F.R.S. (*Abstract.*)

Section A.—Mathematics and Physics.

The theoretical researches of Einstein and Weyl suggest that not merely the material universe but space itself is perhaps finite. As to the probabilities I do not wish to express an opinion; but the statement is significant of the extent of the revolution in the conceptions and fundamental principles of physics now in progress. That space need not be infinite has, I believe, long been recognised by geometricians, and appropriate geometries to meet its possible limitations have been devised by ingenious mathematicians. I doubt, however, whether these inventive gentlemen ever dreamed that their schemes held any objective validity such as would assist the astronomer and the physicist in understanding and classifying material phenomena. It is not certain that they will; but the possibility is definite. Apart from this, the whole development of relativity is an extraordinary triumph for pure mathematics. Had Einstein not found his entire calculus ready to hand, owing to the purely mathematical work of Christoffel, Riemann, and others, it seems certain that the development of generalised relativity would have been much slower. It is a pleasure to be able to acknowledge this indebtedness of physics and astronomy to pure mathematics. Relativity is the revolutionary movement in physics which has caught the public eye, perhaps because it deals with familiar conceptions in a manner which for the most part is found pleasantly incomprehensible. But it is only one of a number of revolutionary changes of comparable magnitude. The various consequences of the electronic structure of matter are still unfolding themselves to us, and are increasing our insight into the most varied phenomena at a rate which must have appeared incredible only a few decades ago. The enormous and far-reaching importance of the discoveries being made at Cambridge by Sir Ernest Rutherford cannot be overemphasised. These epoch-making discoveries relate to the structure and properties of the nuclei of atoms. At the present time we have, I think, to accept it as a fact that the atoms consist of a positively charged nucleus of minute size, surrounded at a fairly respectful distance by the number of electrons requisite to maintain the structure electrically neutral. The nucleus contains all but about one-two-thousandth part of the mass of the atom, and its electric charge is numerically equal to that of the negative electron multiplied by what is called the atomic number of the atom, the atomic number being the number which is obtained when the chemical elements are enumerated in the order of the atomic weights; thus hydrogen = 1, helium = 2, lithium = 3, and so on. Consequently the number of external electrons in the atom is also equal to the atomic number. The evidence, derived from many distinct and dissimilar lines of inquiry, which makes it necessary to accept the foregoing statements as facts, will be familiar to members of this Section of the British Association, which has continually been in the forefront of contemporary advances in physical science. But one of the important pieces of evidence was supplied by Prof. Barkla's researches on the scattering of X-rays by light atoms. The diameters of the nuclei of the atoms are comparable with one-millionth of one-millionth part of a centimetre, and the problem of finding what lies within the interior of such a structure seems at first sight almost hopeless. It is to this problem Rutherford has addressed himself by the direct method of bombarding the nuclei of the different atoms with the equally minute high-velocity helium nuclei (alpha-particles) given off by radioactive substances, and examining the tracks of any other particles which may be generated as a result of the impact. A careful and critical examination of the results shows that hydrogen nuclei are thus expelled from the nuclei of a number of atoms such as nitrogen and phosphorus. On the other hand, oxygen and carbon do not eject hydrogen under these circumstances, although there is evidence in the case of oxygen and nitrogen of the expulsion of other sub-nuclei whose precise structure is a matter for further inquiry. The artificial transmutation of the chemical elements is thus an established fact. The natural transmutation has, of course, been familiar for some years to students of radioactivity. The philosopher's stone, one of the alleged chimeras of the mediæval alchemists, is thus within our reach. But this is only part of the story. It appears that in some cases the kinetic energy of the ejected fragments is greater than that of the bombarding particles. This means that these bombardments are able to release the energy which is stored in the nuclei of atoms. Now, it is known from the amount of heat liberated in radioactive disintegration that the amount of energy stored in the nuclei is of a higher order of magnitude altogether, some millions of times greater, in fact, than that generated by any chemical reaction such as the combustion of coal. In this comparison, of course, it is the amount of energy per unit mass of reacting or disintegrating matter which is under consideration. The amounts of energy which have thus far been released by artificial disintegration of the nuclei are in themselves small, but they are enormous in comparison with the minute amounts of matter affected. If these effects can be sufficiently intensified there appear to be two possibilities. Either they will prove uncontrollable, which would presumably spell the end of all things, or they will not. If they can be both intensified and controlled then we shall have at our disposal an almost illimitable supply of power which will entirely transcend anything hitherto known. It is too early yet to say whether the necessary conditions are capable of being realised in practice, but the speaker sees no elements in the problem which would justify us in denying the possibility of this. It may be that we are at the beginning of a new age, which will be referred to as the age of sub-atomic power.

Thermionic Emission.—At the Manchester meeting of the Association in 1915, when the speaker opened a discussion on thermionic emission—the emission of electrons and ions by incandescent bodies—the opinion was expressed by some of the speakers that these phenomena had a chemical origin. That view is one which would find very few supporters now. It is not that any new body of fact has arisen in the meantime. The important facts were all established before that time, but they were insufficiently appreciated, and their decisiveness was inadequately realised.

It may be worth while to revert for a moment to the issues in that controversy, already moribund in 1915, because it has been closely paralleled by similar controversies relating to two other groups of phenomena—namely, photoelectric emission and contact electromotive force—which, as we shall see, are intimately connected with thermionic emission. The issue was not as to whether thermionic emission may be looked upon simply as a type of chemical reaction; this would have been largely a matter of nomenclature. There is a good deal to be said for the point of view which regards thermionic emission as an example of the simplest kind of reversible chemical action, namely, that kind which consists in the dissociation of a neutral atom into a positive residue and a negative electron, inasmuch as we know that the negative electron is one of the really fundamental elements out of which matter is built up. It was suggested that the phenomenon was not primarily an emission of electrons from the metallic or other source, but was a secondary phenomenon, a kind of by-product of an action which was primarily a chemical reaction between the source of electrons and some other material substance such as the highly attenuated gaseous atmosphere which surrounded it. This suggestion carried with it the view that the source of power behind the emission was not the thermal energy of the source, but was the chemical energy of the postulated reactions. Establishing the primary character of the phenomenon does not, however, determine its nature or its immediate cause. Originally the speaker regarded it as a manifestation of the fact that as the temperature rose the kinetic energy of some of the electrons would begin to exceed the work of the forces by which they were attracted to the parent substance. It is permissible to inquire how the escaping electrons obtain the necessary energy. One answer is that the electrons have it already in the interior of the substance by virtue of their energy of thermal agitation. But thermal agitations now appear less simple, and do not exhaust the possibilities. We know that when light of short enough wave-length falls on matter it causes the ejection of electrons from it—the so-called photo-electric effect. Since the formula for the radiation emitted by a body at any given temperature contains every wave-length without limitation, there must be some emission of electrons from an incandescent body as the result of the photoelectric effect of its own luminosity. Two questions arise. Will this photoelectric emission caused by the whole spectrum of the hot body vary as the temperature of the incandescent body is raised in the way which is known to characterise thermionic emission? A straightforward thermodynamic calculation shows that this is to be expected from the theoretical standpoint, and the anticipation has been confirmed by the experiments of Prof. W. Wilson. Thus the autophotoelectric emission has the correct behaviour to account for the thermionic emission. The other question is: Is it large enough? When every allowance is made, the conclusion is that the photoelectric effect of the whole spectrum is far too small to account for thermionic emission. The same dilemma is met with in the search for the actual *modus operandi* of evaporation, chemical action, and a number of other phenomena. These, so far as we know, might be fundamentally either kinetic or photochemical or a mixture of both. The last alternative is thought the most probable. The term "Photochemical" is used in the wide sense of an effect of light in changing the composition of matter, whether the parts affected are atoms, groups of atoms, ions, or electrons. The photochemical point of view has recently been put very strongly by Perrin, who would make it the entire *motif* of all chemical re-

action, as well as of radioactivity and changes of state. The speed of chemical decomposition of certain gases is independent of their volume, showing that the decomposition is not due to molecular collisions. The speed does, however, increase very rapidly with rising temperature. What the increased temperature can do except increase the number and intensity of the collisions, and increase the amount of radiation received by the molecules, is not too obvious. It seems, however, that, according to calculations by Langmuir, the radiation theory does not dispose of this difficulty; for, just as in the ordinary photoelectric case, there is not enough radiation to account for the observed effects. It seems that in the case of these monomolecular reactions the phenomena cannot be accounted for either by simple collisions, or by radiation, or by a mixture of both, and it is necessary to fall back on the internal structure of the decomposing molecule. This cannot at present be regarded as much more than a field for speculation.

Contact Electricity.—A controversy about the nature of the contact potential difference between two metals, similar to that referred to in connection with thermionic emission, has existed for over a century. In 1792 Volta wrote: "The metals . . . can by themselves, and of their own proper virtue, excite and dislodge the electric fluid from its state of rest." The contrary position that the electrical manifestations are inseparably connected with chemical action was developed a few years later by Fabroni. Since that time electrical investigators have been fairly evenly divided between these two opposing camps. Among the supporters of the intrinsic or contact view of the type of Volta we may recall Davy, Helmholtz, and Kelvin. On the other side we have to place Maxwell, Lodge, and Ostwald. In 1862 we find Lord Kelvin writing: "For nearly two years I have felt quite sure that the proper explanation of voltaic action in the common voltaic arrangement is very near Volta's, which fell into discredit because Volta or his followers neglected the principle of the conservation of force." On the other hand, in 1896 we find Ostwald referring to Volta's views as the origin of the most far-reaching error in electrochemistry, which the greatest part of the scientific work in that domain has been occupied in fighting almost ever since. These are cited merely as representative specimens of the opinions of the protagonists. Now, there is a close connection between thermionic emission and contact potential difference, and the speaker thinks that a study of thermionic emission has already settled this dispute. How is it that there is a connection between thermionic emission and contact potential difference? and what is the nature of that connection? Imagine a vacuous enclosure, either impervious to heat or maintained at a constant temperature, containing two different electron-emitting bodies, A and B. Let one of these, say A, have the power of emitting electrons faster than the other, B. Since they are each receiving as well as emitting electrons, A will acquire a positive and B a negative charge under these circumstances. Owing to these opposite charges A and B will now attract each other, and useful work can be obtained by letting them come in contact. After the charges on A and B have been discharged by bringing them in contact, let the bodies be quickly separated and moved to their original positions. This need involve no expenditure of work, as the charges arising from the electron emission will not have had time to develop. After the charges have had time to develop the bodies can again be permitted to move together under their mutual attraction, and so the cycle can be continued an indefinite number of times. In this way we have succeeded in imagining a device which will convert all the heat energy from a source at a uniform temperature into useful work. Now, the existence of such a device would contravene the second law of thermodynamics. We are therefore compelled either to deny the principles of thermodynamics or to admit that there is some fallacy as to the pretended facts in the foregoing argument. We do not need to hesitate between these alternatives, and we need only look to see how the alleged behaviour of A and B will need to be modified in order that no useful work may appear. There are two alternatives. Either A and B necessarily emit equal numbers (which may include the particular value zero) of electrons at all temperatures, or the charges which develop owing to the unequal rate of emission are not discharged, even to the slightest degree, when the two bodies are placed in contact. The first alternative is definitely excluded by the experimental evidence. The second means that bodies have natural states of electrification whereby they become charged to definite potential differences whose magnitudes are independent of their relative positions. There is an intrinsic potential difference between A and B which is the same, at a given temperature, whether they are at a distance apart or in contact. Admitting that the intrinsic potentials exist, a straightforward calculation shows that they are intimately connected with the magnitudes of the thermionic emission at a given temperature. The relation is, in fact, governed by the following equation: If A and B denote the saturation thermionic currents per unit area of the bodies A and B respectively, and V is the contact potential difference between them at the absolute temperature T, then $V = \frac{k}{e} T \log \frac{A}{B}$ where k is the gas constant calculated for a single molecule (Boltzmann's constant), and e is the electronic charge. The speaker and Mr. F. S. Robertson have made measurements of the contact potential difference between heated filaments and a surrounding metallic cylinder, both under the high-vacuum and gas-free conditions which are now attainable in such apparatus, and also when small known pressures of pure hydrogen are present. As is well known, both contact potentials and thermionic emission are very susceptible to minute traces of gas, but it is found that under the best conditions as to freedom from gas there is a contact potential of the order of one volt between a pure tungsten filament and a thoriated filament. They have also been able to measure the thermionic emissions from the filaments at the same time, and find that the contact potential calculated from them with the help of the foregoing equation is within 20 per cent. of the measured value. Considering the experimental difficulties, this is a very substantial agreement. Whilst the evidence is not yet as complete as it is hoped to make it, it goes a long way towards disproving the chemical view of the origin of contact potential difference. From what has been said, it will be realised that the connection between contact potentials and thermionic emissions is a very close one. To account for the facts of thermionic emission it is necessary to assume that the potential energy of an electron in the space just outside the emitter it greater than that inside by a definite amount, which we may call w. The existence of this w, which measures the work done when an electron escapes from the emitter, is required by the electron-atomic structure of matter and of electricity. Its value can be deduced from the temperature variation of thermionic emission, and, more directly, from the latent heats absorbed or generated when electrons flow out of or into matter. These three methods give values of w which, allowing for the somewhat considerable experimental difficulties, are in fair agreement for any particular emitter. The data also show that in general different substances have different values of w. This being so, it is clear that when uncharged bodies are placed in contact, the potential energies of the electrons in one will, in general, be different from those of the electrons in the other. If, as in the case of the metals, the electrons are able to move freely they will so move until an electric field is set up which equilibrates this difference of potential energy. There will thus be an intrinsic or contact difference of potential between metals which is equivalent to the difference in the value of w and is equal to the difference in w divided by the electronic charge.*

Photoelectric Action.—It has been seen that there is a connection on broad lines between thermionic emission and both contact potentials on the one hand and photoelectric emission on the other. The three groups of phenomena are also related in detail and to an extent which up to the present has not been completely explored. Perhaps the most striking feature of photoelectric action is the existence of what has been called the threshold frequency. For each metal whose surface is in a definite state there is a definite frequency n_0, which may be said to determine the entire photoelectric behaviour of the metal. The basic property of the threshold frequency n_0 is this: When the metal is illuminated by light of frequency less than n_0 no electrons are emitted, no matter how intense the light may be. On the other hand, illumination by the most feeble light of frequency greater than n_0 causes some emission. The frequency n_0 signalises a sharp and absolute discontinuity in the phenomena. Owing to the fact that the electrons emitted by a metal when illuminated by monochromatic light of frequency, let us say, n, may originate from different depths in the metal, and may undergo collisions at irregular intervals, it is only the maximum kinetic energy of those which escape which would be expected to exhibit simple properties. As a matter of fact, it is found that the maximum kinetic energy is equal to the difference between the actual frequency n and the threshold frequency n_0 multiplied by Planck's constant h. In mathematical symbols, if v is the velocity of the fastest emitted electron, m its mass, e its charge, and V the opposing potential required to bring it to rest,

$$eV = \tfrac{1}{2} m V^2 = h (n - n_0).$$

From this equation it is seen that the threshold frequency is evidently that frequency for which kinetic energy and stopping potential fall to zero. This suggests strongly that the reason the electron emission ceases at n_0 is that the electrons are not able to get enough energy from the light to escape from the metal, and not that they are unable to get any energy from the light. If the threshold frequencies for any pair of metals, and the contact difference of potential K between them are measured, we find that K is equal to the difference between their threshold frequencies multiplied by this same constant h divided by the electronic charge e. These results admit of a very simple interpretation if it is assumed that when illuminated by light of frequency n the electrons individually acquire an amount of energy hn. It has been seen that in order to account for thermionic phenomena it is necessary to assume that the electrons have to do a certain amount of work w to get away from the emitter. There is no reason to suppose that photoelectrically emitted electrons can avoid this necessity. Supposing that this work is also definite for the photoelectric electrons and denoting its value by hn_0, then no electron will be able to escape from the metal until it is able to acquire an amount of energy at least equal to hn_0 from the light—under the suppositions made—until n becomes at least as great as n_0. Thus n_0 will be identical with the frequency which we have called the threshold frequency, and the maxi-

* This statement is only approximately true. In order to condense the argument certain small effects connected with the Peltier effect at the junction between the metals have been left out of consideration.

mum energy of any electron after escaping will be $h\ (n-n_0)$. The relation between threshold frequencies and contact potential difference raises another issue. It has been seen that the contact potential difference between two metals must be very nearly equal to the difference between the amounts of work w for the electrons to get away from the two metals by thermionic action, divided by the electronic charge e. The photoelectric experiments show that the contact electromotive force is also nearly equal to the differences of the threshold frequencies multiplied by h/e. It follows that the photoelectric work hn_0 must be equal to the thermionic work w to the same degree of accuracy. We have to except here a possible constant difference between the two. The speaker did not see, however, how any value other than zero for such a constant could be given a rational interpretation, as it would have to be the same for all substances and frequencies. The photoelectric and thermionic works are known to agree to within about one volt. To decide how far they are identical needs better experimental evidence than that available. The indirect evidence for their substantial identity (within the limits of accuracy referred to above) is stronger at the moment than the direct evidence. The complete identity of the thermionic work w and the photoelectric hn_0 is not a matter which can be inferred *a priori*. This depends to a considerable extent on the condition of the electrons in the interior of metals. There is no real knowledge of this at present. Unless the electrons which escape all have the same energy when inside the metal we should expect the thermionic value to be an average taken over those which get out. The photoelectric value, on the other hand, should be the minimum pertaining to those internal electrons which have most energy. The apparent sharpness of the threshold frequency is also surprising from some points of view.

The threshold frequency is a perfectly definite quantity when the condition of the body is or can be definitely specified, but it is extraordinarily sensitive to minute changes in the conditions of the surface, such as may be caused, for example, by the presence of extremely attenuated films of foreign matter. Interesting calculations have been made by Frenkel which bring surface tension into close connection with the thermionic work w. Broadly speaking, there can be little doubt that a connection of this nature exists, but whether the relation is as simple as that given by the calculations is open to doubt. It should be possible to answer this question definitely when there is more precise information about the disposition of the electrons in atoms such as the continuous progress in X-ray investigation seems to promise.

Light and X-Rays.—One of the great achievements of experimental physics in recent years has been the demonstration of the essential unity of X-rays and ordinary light. X-rays have been shown to be merely light of particularly high frequency or short wave-length, the distinction being one of degree rather than of kind. The actual gap in the spectrum of the known radiations between light and X-rays is also rapidly disappearing. The longest stride into the region beyond the ultra-violet was made by Lyman with the vacuum grating spectroscope which he developed. For a short time Prof. Bazzoni and the speaker held the record in this direction with their determination of the short wave limit of the helium spectrum, which is in the neighbourhood of 450 Angstrom units. More recently this has been passed by Millikan, who has mapped a number of lines extending to about 200 Angstrom units—that is to say, more than four octaves above the violet limit of the visible spectrum. The longest X-ray which has been measured appears to be a zinc L-ray by Friman of a wave-length of 12,346 Angstrom units. There is thus at most a matter of about four octaves still to be explored. In approaching this unknown region from the violet end the most characteristic property of the radiations appears to be their intense absorption by practically every kind of matter. This result is not very surprising from the quantum standpoint. The quantum of these radiations is in excess of that which corresponds to the ionising potential of every known molecule, but it is of the same order of magnitude. Furthermore, it is large enough to reach not only the most superficial, but also a number of the deeper-seated electrons of the atoms. There is evidence, both theoretical and experimental, that the photoelectric absorption of radiation is most intense when its quantum exceeds the minimum quantum necessary to eject the absorbing electron but does not exceed it too much. In the simplest theoretical case the absorption is zero for radiations whose frequencies lie below the minimum quantum, rises to a maximum for a frequency comparable with the minimum, and falls off to zero again at infinite frequency. This case has not been realised in practice, but, broadly judged, the experimental data are in harmony with it. On these general grounds we should expect intense absorption by all kinds of matter for the radiation between the ultra-violet and the Z-ray region. The closeness of the similarity in the properties of X-rays and light is even yet inadequately realised. It is not merely a similarity along broad lines, but it extends to a remarkable degree of detail. It is perhaps most conspicuous in the domains of photoelectric action and of the inverse phenomenon of the excitation of radiation or spectral lines by electron impacts. Whilst there may still be room for doubt as to the precise interpretation of some of the experimental data, the impression formed is that each important advance tends to unify rather than to disintegrate these two important groups of phenomena.

The Reception of Wireless Waves on a Shielded Frame Aerial.

By Alan A. Campbell Swinton, F.R.S. (*Abstract.*)

Section A.—Mathematics and Physics.

The following experiments were recently carried out by the author in his laboratory in London, in order to test a suggestion made by Mr. N. P. Hinton, a member of the Sub-committee on Directional Wireless of the Radio Research Board, that something of the nature of a wireless "telescope," with improved direction-finding properties, might be made by placing a frame aerial in a large metal tube or wire spiral open at the ends. Particulars are published with the permission of the Radio Research Board.

The frame employed was a circular one, 1 ft. in diameter, with 100 total turns of No. 20 S.W.G. cotton-covered copper wire, all the turns bunched together, with a four-way switch so arranged that the number of turns in use could be diminished to 20, 40, or 80 turns, as desired. With 80 turns in use, and with an adjustable condenser connected across its ends, this frame recorded, in London, the spark emission from the Eiffel Tower in Paris loudly when coupled to a 5-valve resistance amplifier connected to a 3-valve transformer-coupled note magnifier, and had fairly good directional properties. All the experiments were made with the spark emission from Paris, which has a wave-length of 2,600 metres. The shielding tube first employed consisted of an oblong wooden frame of square section, 18 in. wide, 18 in. deep, and 4 ft. long, wound round with No. 18 S.W.G. bare copper wire spaced 1 in. apart, and connected to earth. With the ends of the tube open, and with the extremities of the square copper spiral unconnected, the frame, when placed within the tube, gave signals from Paris of approximately the same strength as outside of the tube. When, however, the ends of the spiral were connected together so as to form a closed circuit, the signals received on the frame were considerably weakened, say, by about 50 per cent., and this weakening was accentuated so that the signals only retained about 25 per cent. of their original strength by short-circuiting the individual spirals with four longitudinal copper wires along the corners of the tube. It was found, however, that the tube itself possessed no appreciable directional screening effect upon the frame, it making no detectable difference in what direction the tube was pointed provided the frame itself was in the plane pointing to Paris. This continued to be the case even when the open ends of the tube were closed by grids of copper wire connected at numerous points to the spiral, the putting on or removal of these grids making no noticeable difference in the strength of the signals. Finally, the whole tube, including its ends, was completely covered in with iron wire netting of about ¼ in. mesh in contact with the copper spiral and end grids, when it was found that, although the signals were slightly further diminished in intensity, to about 20 per cent. of their original strength, Paris could still be easily heard on the frame, which continued to have directional properties quite irrespective of the position of the wire-netting-covered tube. It would appear from the experiments that, while completely enclosing the frame in a conducting network considerably damped the currents in the frame, and thus diminished the strength of the signals, this conducting network by no means entirely screened the frame from incoming waves of the 2,600-metre length sent out on the spark emissions of the Eiffel Tower. The result would appear to be dependent on the considerable wave-length tested, as copper wire grids such as are mentioned above, with the wire parallel to the plane of polarisation of the waves, pretty well completely screen off the very short waves of a few centimetres length such as were used in the original lecture-room experiments with Hertzian waves many years ago by Sir Oliver Lodge.

Further experiments were made with the frame placed within a box in the form of a 2-ft. cube made of sheet copper about 1/32nd of an inch thick. This box was completely closed in with soldered joints excepting on one side, which was open, but which could be closed by means of a close-fitting lid also made of similar sheet copper. In all the experiments this copper box was connected to earth. The same circular frame aerial 1 ft. in diameter, used in the previous trials, was employed, but a more compact transformer-coupled 6-valve amplifier was used in place of the 5-valve resistance amplifier and the separate 3-valve note magnifier. In this box was placed not only the frame, but also the amplifier and all the other apparatus, the telephone being listened to through a rubber pipe. Signals were heard of equal strength with the open end of the box pointing towards, or directly away from, Paris, but ceased when the box was turned so that the open end faced at right angles to Paris, the frame still pointing to Paris; or when the open end was completely closed with a copper or tinfoil cover. In the latter case the signals were still audible unless the cover actually touched the box on all sides. For other positions of the box with the end open, signals could only be heard when the relative positions of the box and frame were such that a prolongation of the plane of the frame towards, or away from, Paris, no matter which, came out of the open end clear of the copper sides of the box.

The result obtained with the frame inside the copper box, in getting signals of equal strength with the open side of the box facing away from the source of the waves as when

the open side faced towards such source, may perhaps be of some interest from the point of view of theory, in throwing some light upon the mechanism of electromagnetic wave phenomena, inasmuch as it gives evidence that, in addition to what is analogous to a "push" upon an aerial in front of the wave front, there is also something of the nature of a "pull" upon an aerial behind the wave front. Otherwise, the experiments go to show that, at any rate upon the small scale employed, the use of a shielding tube or box does not assist in improving directional reception. It is possible, however, that if tried on a larger scale, with much more space between the frame and the shield so as to avoid damping, the results might be different.

Cost-of-Living Sliding Scales.

By Miss G. Jebb. (*Abstract.*)

Section F.—Economics.

In this paper it is argued that the effect on distribution of the automatic adjustment of wages to changes in the cost of living depends mainly on the cause of the change in price level. When a rise in prices is due to currency or credit expansion, or a fall in prices is due to currency or credit contraction, the cost-of-living sliding scale tends to prevent arbitrary changes in the distribution of real income. When, however, price changes are the result of changes in the volume of production the effect is reversed. If prices are rising because goods are diminishing the purchasing power of wages can only be maintained at the expense of other incomes. Conversely, if prices are falling because goods are increasing the automatic reduction of wages to keep pace with prices lessens the relative share of the wage-earner in the goods income.

The Breakdown of the Minimum Wage.

By A. A. Mitchell. (*Abstract.*)

Section F.—Economics.

In all the recent wages controversies, it seems to have been assumed as an axiom that wages must conform to a predetermined standard of living. This conception seems to find little or no place in economic textbooks. On the other hand, there seems to have been little or no audible protest on the part of economists. According to the subsistence theory of wages, it is impossible for general wages to fall below what is required to keep not each individual workman but the supply of workmen in existence. That purports to be true economic law, a corollary from the laws of supply and demand, population and diminishing returns. A wage based on an arbitrary standard of life beyond actual subsistence is not based on economic law, though of course it may be made a matter of legal or moral obligation. Minimum wage is inconsistent with the nature of wage which is a payment for a service. No one is compelled to employ at all, and no one can be compelled to employ at a loss. Even the rulers of a socialist state could give their workmen no more than an equal share of the total national product, which might very well be less than the desired standard. We are coming near, or perhaps have reached, the point where the entire wealth of the country is insufficient to pay the wages that are demanded. A wage based on standard of living, not on the value or selling price of the product, tends to (*a*) unemployment, (*b*) inefficiency.

GERMAN COMMERCIAL PENETRATION IN SWITZERLAND.

The *Anglo-Swiss Review* has performed a useful service by drawing attention to a recent article published by the *Gazette de Lausanne*, which in turn quotes various German-Swiss newspapers in support of its complaints, concerning the commercial penetration of Switzerland by German companies, which on the one hand seek to elude Swiss vigilance by the formation of holding companies in Switzerland, and on the other to evade, if possible, the taxes on joint-stock companies in Germany, which are higher than those in force in Switzerland. The holding companies have their headquarters and administration in Switzerland, while the industrial equipment, works, stocks, and effective management are located in Germany. Among the other objects aimed at by the holding companies is said to be the intention to escape the taxes placed by the Allies on German exports by sending goods abroad "naturalised" in Switzerland, while again Swiss houses are sought to be absorbed by the investment of capital in them in order to gain control over a group of industries, and thus conquer the Swiss market.

As Swiss joint-stock legislation requires that the board of directors of a company shall have a majority of Swiss subjects, it is nominally impossible for Germans to have a majority; but this difficulty is overcome in a very simple way. If, for instance, a board consists of eleven members, six of them must be Swiss, while five can be foreigners. The Lausanne newspaper states that the Germans always arrange to have on the board one or two Swiss who lend their names, or neo-Swiss, newly naturalised, whose complaisance can be relied on, and the thing is done. In this connection it is unsatisfactory to be told that "there are Swiss, even of good old stock, bearing highly respected names, who consciously or unconsciously lend themselves to this kind of thing." The Swiss organ refers to what is termed a typical case—namely, that of the Industrial Securities Co., which was formed at Lucerne in June, 1920, with a share capital of 2,500,000 fr., which is to be increased to 32,000,000 fr. by means of an agreement with the Sichel Co., of Mayence, which company is declared to have just laid hands on several electrical works in central Switzerland, and also obtained possession of the Swiss production of calcium carbide. A second instance mentioned is that of a mill construction company which is administered by Swiss at Basle, and which is stated to be simply a branch of the German industry ambushed in Switzerland to compete unfairly with Swiss industry; and the newspaper says that further cases of this insidious penetration could be cited, which is accentuated at the very moment when Swiss export trade is *in extremis*.

If our Swiss contemporaries have not short memories, they will remember that the German invasion, although perhaps in a slightly different form, commenced many years before the great war. As the files of this journal show, the Zürich Bank für Elektrische Unternehmungen was originally conceived by, and formed with the co-operation of, the Berlin A.E.G., for the investment of capital in supply companies and tramway undertakings and the grant of loans to them, with the ultimate object of procuring from Germany the machinery and plant required by these undertakings. Those who financed these undertakings generally dictated the allocation of the orders placed by the latter. It would be of particular interest in this connection to learn how many of these undertakings apportioned their orders to Swiss native electrical manufacturing works. We also have some recollection during the course of the war of certain German members of the board of the Neuhausen Aluminium Industry Co. being compelled to resign their positions—nominally or really is a matter of individual opinion—although we believe that most of the share capital is or was held in Germany and that the actual administration was centred at Frankfort-on-Main. It is also well to bear in mind the Petrograd Electric Lighting Co., of 1888, which although a Russian registered company, was controlled by Germans, who supplied such machinery and plant as were not made in Russia. It is, however, believed that the Germans unloaded in Switzerland during the early part of the war as large an amount of their shareholdings in the Russian company as was possible. Although Swiss interests in the latter company, in the course of their negotiations with the late Imperial Russian Government, contended that their shares were acquired in pre-war times, they were unable to convince the Russian authorities of the fact, and the latter refused to recognise any liability to redeem the shares or obligations then in Swiss ownership, as the Russian Government held that the Petrograd Electric Light Co., of 1888, was essentially a German concern, and consequently sequestrated the property.

Coming to more recent events, the case of the Alpine Montan Co.—the greatest iron and steel company in post-war Austria—will be fresh in the minds of our readers. The majority control over this Alpine Company was recently secured by Herr August Stinnes on behalf of the Siemens-Rhine-Elbe-Schuckert Union, and the large number of shares taken over has, for some reason or other, also been vested in a Swiss holding company, and Swiss territory is therefore being utilised for a German scheme in relation to Austria.

The Sichel Co. already mentioned, or—to give it its proper title—Julius Sichel & Co., Partnership company of Mayence, is an undertaking having wide financial interests in German iron and steel works and other industrial concerns in that country, and is also connected with the well-known Belgian steel company, the Société d'Ougrée-Marihaye. At the moment the Sichel Co. is on the point of concluding an agreement with the steel merchant and metal firm of Wolf Netter and Jacobi, of Berlin and Frankfort-on-Main, on the basis of a community of interests. In addition the present parts (shares) of 50,000,000 marks in the Sichel Co. are now to be exchanged for shares in the A.G. fur Industriwerte (the previously cited Industrial Securities Co.) of Lucerne, whose existing share capital of 12,500,000 fr. is to be provisionally increased to 32,000,000 fr. for the purpose of carrying out the transaction. Thus the Sichel Co. will be transferred to a Swiss holding company, and the Mayence branch, in the words of a German newspaper, will merely become an appendage of the Lucerne concern.

The whole problem of German "illicit" invasion naturally rests with our Swiss friends as being a national matter which directly concerns themselves. It is therefore satisfactory to learn from the Lausanne newspaper that the danger of the insidious penetration and the harm which it may do abroad to the good Swiss name have been recognised by the Federal authorities, who in recent years have modified the laws respecting the registration of commercial firms, making them more severe and applying them more vigorously. But as attempts to defraud become more numerous as legislation becomes more severe, the Federal Council has just submitted to Parliament a Bill to deal further with the subject. The Bill provides for the imposition of heavy penalties, up to one year's imprisonment, and a fine of 20,000 fr., in cases where deception is exercised as regards nationality in connection with the registration of limited companies. The Lausanne newspaper concludes with the expression of the hope that when passed the measure will be successful in combating German camouflage, as the economic independence of Switzerland is at stake.

ELECTRICAL ENTERPRISE IN CZECHO-SLOVAKIA.

On July 22nd, 1919, the Czechoslovak National Assembly passed an Electricity Bill, the purpose of which is the systematic utilisation of water power and the electrification of the country, with the financial assistance of the State.

The electrical industries in Czecho-slovakia are very considerable, and, especially in recent years, the shortage of coal and petroleum has caused an increase in the employment of electricity as a motive power both for lighting and domestic services to a very large extent.

The present annual requirements in electrical energy, not including the needs of the railways, are about 2.5 milliard kWh. This demand is met by 345 electrical concerns, which are intended for the public supply, while in addition, a considerable number of power stations supply private needs.

In future the energy is to be supplied by a uniform system of 22,000 and 100,000 volts, being generated by nine large thermo-electric power stations in the coal districts out of which the three largest will be set up at Duchcov (Dux) (Bohemia), Moravska Ostrava (Moravia), and in Slovakia. In addition, water power stations will be erected on all the rivers in the republic.

According to statistics relating to Bohemia and Moravia, the chief provinces of the new State, the output from water power in millions of kWh, is estimated as follows: In Bohemia, Labe (Elbe) above Hradoc Kralovo, 17; Hradoc Kralovo-Melnik, 87; below Melnik, 92; tributaries, 76; Vltava (Moldau) above Ces. Budejovice, 156; Ces. Budejovice-Prague, 450; Prague-Melnik, 106; tributaries, 674. Hence, these two main rivers can supply 1,658,000,000 kWh.

In Moravia the following rivers are important: Morava (March), 2; Svarcava, 22; Johlavka, 35; Dyje, 103; making a total of 162,000,000 kWh.

To this, however, Silesia and Slovakia must be added. In Slovakia especially, the water power resources are almost unlimited. If the capacity of water power is estimated at only 800,000 h.p., an annual saving of 6 million tons of coal will be effected, which is about 20 per cent. of the entire coal output.

In accordance with the Bill, the State will take over the development of water power and construction of water power plants, while the construction of transmission and distribution systems and thermo-electric plants will be left to companies, at least 60 per cent. of whose capital will be held by the State and local authorities, and the remainder by private shareholders. The State will have to secure a permanent interest in the management of these companies. For 1919, 8 million crowns were appropriated for this purpose and included in the State Budget.

The estimated costs of the complete electrification scheme according to published figures, will amount to two milliard Czechoslovak crowns for the construction of hydro-electric plants, and ½ milliard crowns for plants driven by steam power. The transmission system will cost about ½ milliard crowns, and the distribution system the same amount.

The National Assembly has assigned 75 million crowns towards the commencement of this systematic electrification. This sum is to be distributed by instalments over the annual Budgets from 1919 to 1928. The money will be placed at the disposal of the Ministry of Public Works for the erection of hydro-electric plants, and for the financial co-operation of the State in any electrical undertakings which may form a substantial part of the system.

The building of the thermo-electric power stations and the system of mains is spread over 20 years, and the construction of the water power stations over 50 years. At present new large electrical associations are in course of formation, and a Government Commission has been established to deal with all matters concerning the electrification.

REVIEWS.

Telegraphy, Telephony, and Wireless. By J. Poole. 120 pp.; 68 figs. London: Sir I. Pitman & Sons, Ltd. Price 3s. net.

This book is one of the well-known "Common Commodities and Industries Series," which fact, together with the author's reputation, is a sufficient guarantee of its excellence. The aim is to provide a general introduction to the three main electrical methods of transmitting intelligence, and the historical method of treatment has been adopted in order that the reader—whether young or old—who is new to the subject, may appreciate the technical growth of the methods and applications of telegraphy and telephony.

The general principles of electricity and magnetism, sources of electromotive force, bells and relays, are first considered. It is doubtful whether the layman will be able to follow the author completely (for instance, inductive capacity in relation to inductance between wires is mentioned on p. 11!), but the writer certainly explains the subject as clearly as possible in the space available, and if there is a demand for such a technical treatise in this series the reader must be prepared for some difficulty in the above direction. Personally, we should imagine that the book would be more useful to the technical student and to the junior engineer or workman in the fields covered. The commercial and industrial aspect which is given prominence in other volumes of this series is not considered in the present volume. This, however does not detract from the excellence of the treatment which is actually presented. It would be impossible to deal with both the technical side and the broader commercial aspect in a single volume of this size.

In two chapters, occupying only 55 pages, the author accomplishes the remarkable feat of explaining the construction and action of all the main types of telegraph and telephone apparatus from the original inventions down to the multiplex telegraph systems and the telephone exchange systems of to-day—including useful notes on automatic exchanges. The reader with some grounding in electrical matters could not wish for a more concise and useful introduction to the subject, but it is doubtful whether a layman could follow the treatment. The short chapter on telegraph and telephone lines does not offer such great technical difficulties, and the two concluding chapters, on wireless telegraphy and telephony, appear to be less severely technical than those on the wire systems.

This volume is technically sound, excellently written and produced, and is recommended confidently as an exceptionally comprehensive and accurate introduction to the subject.

Power Factor Correction. By A. E. Clayton, B.Sc. (Eng.). Pp. xi+108; 36 figs. London: Sir I. Pitman & Sons, Ltd. Price 2s. 6d. net.

The author of this little book has set himself the difficult task of explaining to the ordinary and presumably non-scientific business man a highly intricate scientific subject. Within the limitation which he himself mentions in the preface, he has succeeded fairly well. We are told that his aim has been to present fundamental principles and not a complete analytical treatment; nor has he attempted to give an exhaustive account of all the various inventions brought forward for improving the power factor of machines and lines, but has limited himself to a few devices which have been successful in practical work.

In the first chapter we have the usual explanations regarding power in an alternating-current circuit, power factor and its measurement, the vector diagram, and so forth. In the next chapter the influence of power factor on capital outlay on generating and distributing plant is explained, as is also the fact that low-speed motors have a worse p.f. than high-speed motors, and that a bad p.f. at the delivery end of a line decreases not only the kW, but also the kVA rating of the generator. This leads the author to the consideration of a supply tariff based upon p.f. and to a brief exposition of the Arno and Midland tariffs. At the end of the chapter the author says that the consumer should not be penalised for the "inherent defects of the induction motor." What precisely this means is not clear, and if the sentence were to be strictly interpreted, the book need not have been written.

When describing means for improving the p.f., the author uses analytical and vector methods, also tables worked out for the reduction of wattless current; and here we find a statement regarding the economical limit of correction not previously given in other books. A comparison is made between two methods of meeting an increased demand; one by simply adding to the existing plant, and the other by leaving it as it is, and augmenting its earning capacity by improving the p.f. The author says: "It is never economical to install power factor correcting apparatus if the ratio of the cost per kVA compensated and per kVA to increase the dimensions of the system is greater than the sine of the original angle of lag of the current." This law is scientifically correct, but the numerical example given is hardly consonant with actual finance. In one case the author assumes that the ratio of cost per kVA of the correcting apparatus to the cost per kVA of the whole undertaking is 0.2. Since even at the present time £3 per kVA of phase advancer is an outside figure, this would mean that the whole works from the coal bunker to the consumers' terminals could be put down for £15 per kVA!

For improving the p.f. of the system as a whole the two usual methods, namely, static and rotary condensers, are described. Here the business man might be told something of the financial aspect, but no cost per kVA is given. This could be done for the static condenser, because it is a standard article, although not for the rotary condenser, but in the latter case the author's assumption that the cost per kVA of generating and transmission plant is less than twice the cost per kVA of a rotary condenser is distinctly unfair to the latter, and, therefore, the conclusion that it only pays to use such a phase corrector where the line is very long and costly will not be readily accepted. On the other hand, the author fails to draw attention to the fact that the kW loss in the rotary condenser is going on all the time, whereas the amount of energy supplied varies. The financial efficiency is, therefore, less than the power efficiency calculated for full load. Nevertheless rotaries are in extensive use, especially in America, not only for p.f. correction, but for keeping the delivery voltage at a constant value. We learn that some rotaries up to 3,000 kVA are automatic, and that the largest non-automatic rotary is rated at 15,000 kVA, and is on the Los Angeles system. When dealing with improvement of p.f. of individual motors, the author explains why the kVA must be injected into the

rotor, and he describes both rotary and vibrating types. In discussing the question of power absorbed by the Scherbius, the author falls into an error when he states that the power necessary to drive this machine is only that spent on friction and windage. Although there is no stator to anchor the flux in space, yet the flux is anchored to the brushes and is cut by the armature wires, and the resulting torque must be supplied from outside. Several examples of the performance of vibrators are given, and the action of this advancer is clearly explained. A short account of Kramer's method of phase correction combined with speed control is also given The book will be useful to customers of power supply works.—Gisbert Kapp.

The Electrical Transmission of Photographs. By Marcus J. Martin. Pp. xi+136; 73 figs. London: Sir I. Pitman and Sons, Ltd. Price 6s. net.

This book gives a simple and concise treatment of various methods for transmitting photographs electrically in wire circuits with notes also on the wireless transmission of photographs, and on television which is, of course, the highest development of phototelegraphy. The day will come when it is possible to see as well as to speak wirelessly to someone at the other side of the world. At present, however, the art of phototelegraphy is in a purely experimental stage, and the author's treatment of the subject will aid materially those who wish to experiment in this field. The author has had much practical experience in the work of which he writes, so that he has first-hand knowledge of the difficulties to be overcome.

The introductory chapters review the history of the subject and describe early systems for the electrical transmission of written characters and sketches—culminating in the well-known "Telewriter."

Chapter III describes the electrograph system, which has given very satisfactory experimental results in America. This system utilises a half-tone image etched on a zinc block, the space between the dots of the image being filled with insulating material. A stylus travels over the zinc plate and sends an intermittent current to line according to the occurrence and size of the dots in the image. The latter is reproduced at the receiving station by an electromagnetically operated pen.

Prof. Korn's selenium machines were the first to be used for commercial photo-telegraphy, and this system, which has been used successfully between London and Paris and between London and Manchester, is described in detail in Chapter IV. The author includes some useful information concerning his own experimental experience and apparatus, and this chapter includes some fine specimens of telautograph work which should convince the most sceptical reader as to the ultimate possibilities of telephotography and television.

Amstutz's suggestion that a photograph in relief should be used to vary the resistance of an electrical circuit has been developed very successfully by Prof. Belin, whose telestereograph uses a stylus, travelling over a relief photograph, to vary the setting of a special rheostat (the rheomicrophone), and thus produce current variations which are recorded by an oscillograph. With this system perfect photographic transmission has been obtained between Bordeaux and Paris, a distance of 350 miles.

The Thorne-Baker Telectrograph which is at present the simplest and most efficient system, depends upon electrochemical reproduction of current impulses obtained from a line analysis of the original image. The author describes very thoroughly the working of the system and the various difficulties which have to be overcome.

Chapter V deals with factors which are of importance in all systems of telephotography, such as the source of light to be employed, chromatic aberration, chemical inertia, and so forth. The fascinating nature of the research work awaiting those who seek for commercial systems of television and wireless transmission of photographs is shown clearly in the next two chapters of the book. Concerning radio-photography, the author states that he can now obtain good results over several miles, but that his apparatus needs simplifying before it can be used commercially.

In the final chapter the author gives full working drawings for a machine which he has used for experimental purposes for some years past. Obviously these drawings are most valuable in furnishing the beginner with practical experience, and with the certainty that he can start with something definite.

Electric Furnaces in the Iron and Steel Industry. By W. Rodenhauser, J. Schoenawa, and C. H. Vom Baur. Third edition. Pp. xxi+460; 137 figs. London: Chapman and Hall, Ltd. Price 21s. net.

This book was reviewed very fully in our issue of February 6th, 1914, when it was described as, "beyond all doubt, a standard work . . . full of valuable information from beginning to end." It is a thoroughly practical work, based on personal knowledge of the subjects with which it deals, and is fully illustrated. In the preface to the present edition, the translator and part author, Mr. Vom Baur, refers to the influence of the Great War in placing the electric steel industry on a solid footing, and mentions that one thousand steel furnaces are either built or building. In common with other industries, it has felt the depressing effects of the social unrest and industrial difficulties of recent times, but the set-back is only temporary, and the lost ground will be fully retrieved when normal conditions return.

The bulk of the present edition is identical with the last, but numerous corrections and minor alterations have been made to bring the matter up to date. The description of the Thury regulator has been greatly extended, and new illustrations have been introduced in this and other sections. The Rennerfelt furnace is the subject of a new chapter, and the Greaves-Etchells, Snyder, Greene, Moore, Booth-Hall, Vom Baur, and Ludlum furnaces are described. In Part II, materials used in furnace construction, and the electro-metallurgy of iron and steel, considerable additions have been made as the result of experience that has been gained, particularly with regard to iron melting furnaces and steel-making direct from the ore, as well as the production of gray and malleable iron for castings. The work must be regarded as a classic in its special sphere, which is constantly increasing in importance and extent.

Engineering Steels. By Leslie Aitchison, D.Met., B.Sc., M.I.A.E. Pp. 396; plates 118; figs. 119. London: Macdonald & Evans. Price 25s. net.

Now that steel has superseded iron for well-nigh every purpose, this text-book should prove of value to all engineers, for after briefly describing the various methods by which steel is produced, the properties, and especially the mechanical properties of the product, are exhaustively dealt with, as are also the variations of those properties occasioned by heat or other treatment.

Electric steel melting in general, and by the arc and basic processes in particular, is discussed, as are also modern alloy steels. The classification of these alloys acording to their mechanical properties, should prove a useful help in the selection of one suitable to any given purpose, as should also the author's expressed reasons for preferring one type of alloy to another in different applications. In this connection it is evident that the author considers the chemical composition of steel as being of secondary importance to the engineer, and preferably determines its value from considerations of strength, hardness, durability, toughness, &c., all of which qualities and means for their ascertainment are lucidly set out in the book.

In a series of appendices, the influence of sharp corners and scratches, Young's modulus of elasticity, and the properties of steels at high temperatures are separately considered, and various types of testing machines are illustrated and described.

The volume is well got up and profusely illustrated, and we should say of it, as does Professor Unwin in his "Foreword," that it is both scientific and practical, in the best sense of those terms.

Practical Testing of Electrical Machines. By L. Oulton, A.M.I.E.E., and N. J. Wilson, M.I.E.E., Assoc.Am.I.E.E. Pp. 258; 112 figs. London: Sir Isaac Pitman & Sons, Ltd. Price 6s. net.

This volume, which is of handy size for the pocket, is a new and enlarged edition of a work originally published in 1909. In a very concise form it presents an account of the more common tests which are likely to be required on the usual types of electro-magnetic machines. Space has forbidden the introduction of any considerable amount of theory concerning the tests, a fact which perhaps somewhat limits the usefulness of the book from the point of view of students, but little is left unsaid concerning the actual tests themselves, which are accurately described, calculations and tables showing the complete working out of the test results being included.

In the original edition, tests on induction and synchronous motors, alternators, rotary converters, single-phase railway motors, and direct current motors and dynamos were described. In the present edition a chapter on the testing of transformers has been added, and a useful series of extracts from the British Standardisation Rules for Electrical Machines are also included.

The older portion of the book might, perhaps, have been modernised with advantage, thus we find little reference to machines with interpoles, and the method given for the determination of insulation resistance will not appeal to modern testers; they will prefer to make use of some direct-reading type of ohmmeter.

It is of the utmost importance that students and others should be impressed with the necessity of accurately labelling all quantities with which they are concerned, thus each column in a table should be headed both with the name of the quantity and the name of the unit, and the same remark applies to the axes of curves. In the book under notice, insufficient attention is paid to these points, the name of the unit only being frequently used. We feel that a bad example is set which may possibly ultimately lead to misunderstanding on the part of readers.

The book is likely to be useful to those engaged in testing machines, whether in the service of manufacturing firms or of supply companies, the more so as many useful diagrams of test connections are given.

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEPTON-JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

22,084. "Automatic excitation regulator for electric machines." J. T. Irwin and A. Rushton. August 20th.

22,147. "Supports for electrodes in ionic tubes." C. E. Trippe and General Electric Co. August 20th.

22,148. "Electric meters." G. A. Cheetham and Metropolitan-Vickers Electrical Co., Ltd. August 20th.

22,149. "Electrical protective relay apparatus." Metropolitan-Vickers Electrical Co., Ltd. August 20th.

22,151. "Suspension of electric lamps, &c." J. Neale. August 20th.

22,180. "Stage telegraphs." E. Booth and N. R. Booth. August 22nd.

22,195. "Electric heaters." J. Maiden. August 22nd.

22,204. "Dynamos for cycles." F. I. Hoffman. August 22nd.

22,217. "Mounting telephone instruments." B. W. A. O. Bantow, A. Mulder, and J. P. de Roeper. August 22nd. (Holland, December 29th, 1920.)

22,218. "Mounting telephone instruments." B. W. A. O. Bantow, A. Mulder, and J. P. de Roeper. August 22nd. (Holland, June 1st.)

22,244. "Protective devices for electric distribution systems." British Thomson-Houston Co., Ltd., and A. S. Fitzgerald. August 22nd.

22,245. "Differential electric apparatus." British Thomson-Houston Co., Ltd., and A. S. Fitzgerald. August 22nd.

22,273. "Systems for wireless transmission of writing, pictures, &c." M. H. Petersen. August 22nd. (Norway, September 9th, 1920.)

22,286. "Process of covering aluminium with electrolytical deposit of nickel, cobalt, &c." A. Verner. August 22nd.

22,299. "Heater for electric kettles." E. A. Welch. August 23rd.

22,317. "Commutator rotating disk and terminal for ignition sets." J. Judge. August 23rd.

22,324. "Electrical rubbing, cleaning, and flatting machines." H. Markham. August 23rd.

22,332. "Electric converters for use with drum alarm clocks." W. A. L. Beail. August 23rd.

22,334. "Terminal block or switch." Diehl Manufacturing Co. and W. C. Fairweather (Diehl Manufacturing Co.). August 23rd.

22,335. "Electric cord holder." Diehl Manufacturing Co. and W. C. Fairweather (Diehl Manufacturing Co.). August 23rd.

22,345. "Speed-regulator systems." Metropolitan-Vickers Electrical Co., Ltd. August 23rd. (United States, September 11th, 1920.)

22,355. "Electric distributing systems." N. Togami. August 23rd.

22,361. "Electrical connecting and supporting devices." Electric Outlet Co. Inc. August 23rd. (United States, April 5th, 1920.)

22,378. "Burners for electrical yarn gassing machines." Siemens-Schuckertwerke. August 23rd. (Germany, December 18th, 1920.)

22,380. "Electron discharge devices." General Electric Co., Ltd., and B. S. Gossling. August 23rd.

22,389. "Telephone receiver rest or holder." J. H. Rutherford. August 23rd.

22,421. "Electric circuit breakers." G. Wilkinson. August 24th.

22,423. "Means for supporting and adjusting shade holders of electric lamps." O. Moser. August 24th.

22,424. "Dynamo electric machines." J. H. Gath. August 24th.

22,447. "Electric switches." G. H. Ide and F. Painter. August 24th.

22,470. "Transformers for high voltages." Haefely et Cie. Akt.-Ges. E. August 24th. (Switzerland, March 4th.)

22,482. "Process of simultaneously assembling and insulating parts of electric outfits." Robinot de la Pichardais, D. M. G. August 24th. (France, August 25th, 1920.)

22,499. "High-voltage switch plant." Akt. Ges. Brown, Boveri et Cie. August 24th. (Switzerland, April 15th.)

22,500. "Electric switches." C. A. Damey Kingsmill Art Metal & Electric Co. August 24th.

22,521. "Thermostatic controlling devices." British Thomson-Houston Co., Ltd. (General Electric Co.). August 24th.

22,539. "Electric heaters or stoves." C. E. Garratt. August 25th.

22,546. "Shade-supporting or lamp-locking device for electric lamps." J. C. Whitlock. August 25th.

22,559. "Electric burglar alarm circuits." H. Eisler. August 25th.

22,583. "Magnetic separators." J. S. Atkinson, Powdered Fuel Plant Co., Ltd. August 25th.

22,584. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. August 25th. (United States, September 3rd, 1920.)

22,585. "Electrodes." British Thomson-Houston Co., Ltd. (General Electric Co.). August 25th.

22,591. "Electric light fitting for ships' berths, &c." M. J. Railing and C. W. Saunders. August 25th.

22,602. "Electric switches, &c." C. A. Damey. August 25th.

22,606. "Self-induction coil pair for loading telephone lines." Felten & Guilleaume Carlswerk Akt. Ges. August 24th. (Germany, January 17th.)

22,311. "Switches for charging batteries, &c." Standard Time Co., Ltd., and A. B. Webber. August 25th.

22,614. "Apparatus for transforming crystal structure of wires, filaments, &c." General Electric Co., Ltd. (Patent Treuhand Ges. fur Elektrische Gluhlampen). August 25th.

22,640. "Electric motor attachment for bath chairs, tricycles, &c." A. C. Nobbs. August 26th.

22,644. "Electric regulators, resistance switches, &c." W. G. Pipkin Veritys, Ltd. August 26th.

22,657. "Magneto electric generators." W. P. Thompson (Splitdorf Electrical Co.). August 26th.

22,680. "Motor controller." W. Fairweather (Singer Manufacturing Co.). August 26th.

22,684. "Thermionic valves." W. H. Le Marechal and Siemens Bros. and Co., Ltd. August 26th.

22,704. "Portable electric lamp." F. A. Jennings. August 26th.

22,716. "Cooling and ventilating systems for dynamo-electric machines." British Thomson-Houston Co., Ltd., and H. W. Taylor. August 26th.

22,717. "Electric motors." British Thomson-Houston Co., Ltd. (General Electric Co.). August 26th.

22,722. "Electric and gas fires." H. H. Berry. August 26th.

22,724. "Calling devices operated by wireless signals." W. J. Davis. August 26th.

22,726. "Dynamos, &c." E. E. Collins. August 26th.

22,735. "Supplying electric current for internal-combustion engines for lighting, &c." G. Constantinesco. August 27th.

22,756. "Switch fuses." C. W. McDowall (Norwest Electrical Manufacturing Co., Ltd.). August 27th.

22,764. "Lighting sets for motor cycles, &c." J. E. Collins. August 27th.

22,786. "Multiplex telephony." E. K. Sandeman. August 27th.

22,795. "Commutator mica reducing tool." J. Burkett. August 27th.

22,798. "Electric incandescent lamps." Naamlooze Vennootschap Philips' Gloeilampen Fabrieken. August 27th. (Holland, September 2nd, 1920.)

22,800. "Dynamo-electric machines." J. Bijur. August 27th. (United States, November 8th, 1919.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

948. "Means for heating rooms and the like electrically." A. M. E. Bevan. November 9th, 1920. (167,507.)

4,766. "Sensitive pressure relays for the amplification of sound waves and other purposes." F. W. Baynes and Mechanical Supplies, Ltd. February 14th, 1920. (167,514.)

6,303. "Electric insulators of the built-up or compound type." A. F. E. Bultemann. March 2nd, 1920. (167,520.)

7,047. "Magnetic chucks." Taft Peirce Manufacturing Co. November 5th, 1914. (140,075.)

7,410. "Production of cipher documents especially adapted for telegraphic dispatch." Aktiebologet Crytograph. October 10th, 1919. (152,625.)

9,446. "Electrical indicators." British L.M. Ericsson Manufacturing Co., Ltd., and W. M. Crowe. April 1st, 1920. (167,522.)

9,929. "Electric table heaters." J. K. Soden. April 5th, 1920. (167,528.)

11,952. "Electric resistance furnaces." A. Imbery. April 30th, 1920. (167,537.)

12,022. "Electric immersion heaters." J. Nolan. April 30th, 1920. (167,539.)

12,028. "Electric heating resistances." Thermos Akt. Ges. January 16th, 1915. (142,505.)

12,334. "Air-cooled electric motors." M. Stamm, M. J. Peltz, and H. Tucker. May 4th, 1920. (167,542.)

12,338. "Remote control circuit breakers and the like." J. Hall. May 4th, 1920. (167,543.)

12,481. "Electric furnaces." British Thomson-Houston Co., Ltd., and G. J. Ralph. May 5th, 1920. (167,545.)

12,533. "Electric switches." E. Cunningham. February 7th, 1921. (167,549.)

12,586. "Sparking plugs." W. R. Marshall. May 6th, 1920. (167,552.)

12,682. "Means for amplifying the sounds of the receivers of telephonic or like instruments." F. H. Gordelier. May 7th, 1920. (Cognate application 13,587/20.) (167,558.)

12,717. "Systems of electric ship propulsion." British Thomson-Houston Co., Ltd. (General Electric Co.). May 7th, 1920. (167,560.)

12,718. "Electric discharge devices." British Thomson-Houston Co., Ltd. (General Electric Co.). May 7th, 1920. (167,561.)

12,808. "High-frequency electric signalling systems." British Thomson-Houston Co., Ltd. (General Electric Co.). May 8th, 1920. (167,567.)

12,833. "Positive electrodes for electric accumulators." A. Pouchain. May 8th, 1920. (167,568.)

12,939. "Positive electrodes for electric accumulators." A. Pouchain. May 10th, 1920. (167,577.)

13,029. "Device for testing and facilitating adjustment of ignition coils and sparking plugs." J. Napier. May 11th, 1920. (167,580.)

13,086. "Thermionic valve transmitting circuits for wireless telegraphy and telephony." A. K. Macrorie and G. Shearing. May 11th, 1920. (167,584.)

13,327. "Electrically-operated motor vehicles." Hansa Lloyd Werke Akt. Ges. July 8th, 1919. (146,935.)

13,330. "Means for connecting the ends of electric or other cables or the like." H. Scholfield. May 14th, 1920. (167,593.)

13,338. "Burglar alarms." E. L. Brynildsen. May 14th, 1920. (167,594.)

13,572. "Electrodes for use in electrolysis." Chile Exploration Co. January 21st, 1920. (157,871.)

13,675. "Electric lighting installations." British Thomson-Houston Co., Ltd. (General Electric Co.). May 18th, 1920. (167,606.)

13,753. "Means for applying electricity to the soil for agricultural purposes." W. Bean. May 19th, 1920. (167,608.)

13,955. "Electric accumulators or secondary batteries." H. Leitner, G. E. Wood, and Greenwood & Batley, Ltd. May 20th, 1920. (167,615.)

14,463. "Fuses for protecting electrically-heated utensils from over heating." E. G. Nicholson. May 27th, 1920. (167,627.)

14,901. "Electric relays suitable for railway signalling systems." R. C. Leake. June 1st, 1920. (167,632.)

16,232. "Electrical fuses." Midland Electric Manufacturing Co., Ltd., and H. E. Sutherland. June 16th, 1920. (167,645.)

16,499. "Electro-mechanical change-speed gear." P. E. H. Malermo and R. E. Raynaud. June 20th, 1919. (145,435.)

16,573. "Spark plugs." Plunkett Energising Spark Plug Corporation. August 31st, 1918. (145,457.)

17,042. "Heavy current relays." E. C. R. Marks (Gleichrichter Akt. Ges.). June 23rd, 1920. (167,652.)

17,714. "Spark plugs." G. W. Noe. June 29th, 1920. (167,658.)

17,727. "Protective covers for electric ignition plugs." A. F. Evans and Royal National Life Boat Institution. June 29th, 1920. (167,659.)

18,442. "Electric welding apparatus." R. F. Woodburn. July 3rd, 1920. (167,662.)

18,797. "Means for and method of regulating transmission over electric circuits." Western Electric Co., Ltd. September 10th, 1918. (146,879.)

23,909. "Reversing the direction of rotation of direct-current dynamo-electric machines." R. Bosch Akt. Ges. August 16th, 1919. (150,275.)

24,046. "Trolley wheels for overhead electric traction." J. Jassaud. August 21st, 1919. (150,284.)

28,212. "Variable hot and cold radial direction electric air diffuser." H. Ashdown. October 5th, 1920. (167,702.)

39,432. "Sparking plugs." Brewster-Goldsmith Corporation Inc. June 9th, 1919. (Divided application on 144,632.)

33,903. "Fuses for electrical circuits." G. Turncock. December 1st, 1920. (167,713.)

35,734. "Electrical cable sockets or lugs." E. Scharpenberg. January 2nd 1920. (156,581.)

1921.

4,900. "Magnetic chucks." Taft Peirce Manufacturing Co. November 5th, 1914. (159,132.) (Divided application on 140,075.)

4,901. "Magnetic chucks." Taft Peirce Manufacturing Co. November 5th, 1914. (159,133.) (Divided application on 140,075.)

5,106. "Apparatus for carrying into effect a process for operating a combined condenser and boiler feed plant." Akt. Ges. Brown, Boveri et Cie. February 16th, 1920. (159,149.) (Addition to 141,015.)